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World Wide Photo

***Back to Work*—Returning employees punch the time clock on resumption of operations at one of the Fisher Body plants**

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Talking Shop

Lament of an S.M.P.

It took place in a Chicago club where the S.M.P. of a western railroad was lunching with a friend. Two men passed the table and sat down in a far corner of the room, heads together.

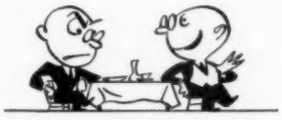
"I know what they're talking about, and I'll hear all about it tomorrow," observed the S.M.P. gloomily.

"Who are they, and how do you know?"

"One of them is operating vice-president of our road, and the other has the same job on another road. Before they get through, my boss is going to tell the other fellow how much running repairs are costing him. And then the other fellow will stick out his chest and tell him that running repairs on his road only cost about half as much."

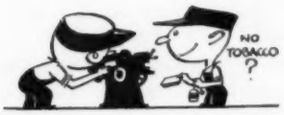
"But if that's so there must be a reason."

"Sure, there's a reason, but my boss has never taken the trouble to investigate our shop equipment, and he won't listen to me when I tell him that 80 per cent of it ought to



be scrapped. He'll just give me thunder because our costs are so high. I could show just as low costs as that other shop if they'd give me the same machines to work with. Most of their equipment is less than ten years old."

This conversation is recorded in the hope that some operating vice-presidents will see it for themselves, or else will have it brought to their notice by other abused superintendents.



Two-Year-Old Grinders

A rather startling replacement policy is advocated by a man who has been a successful proprietor of a small tool and die shop. As a part of it he would dispose of small surface grinders after two years of service. Asked by the man who bought these machines for some fifteen per cent less than their original cost why he sold perfectly good machines, he pointed out that at that rate he was making a pretty good investment.

He went on to say that after two years of steady use minor defects caused by wear might become noticeable at any time. When the toolmaker has to begin correcting for low or high corners by shimming up his chuck with cigarette papers, he can hardly lose less than fifteen minutes on a die while getting the chuck adjusted. In this man's shop many dies were ground. Every fifteen minutes of a toolmaker's time was worth 60 cents to him. With new machines this time was saved and so was the cash it represented. According to his figuring this saving meant the difference between profit and loss. To clinch the argument he pointed out that he was the only tool shop man in that city who was making a profit.

Colored Handles

Plastics are making their way into many fields that have been heretofore preempted by metal. One designer suggests the use of plastic handles for machine tools and especially for those which control different motions. While it might be a bit startling to see a machine with handles of red, blue, green and gray, there may be something to think over in the idea.

Suppose, for example, that red meant rapid traverse, blue indicated forward and gray backward motion, with green reserved for cross feed

or some other function. While some of the skilled men might take it as a reflection on their intelligence, it should make it a lot easier for new men and perhaps save a little in spoiled work.

Cheap Castings

How do you figure whether a casting is cheap or dear? Some shop men turn their purchasing agents loose on the foundrymen and are only happy when they get the lowest possible price per pound. But what quality of iron do they get in castings at such a price?

One gentleman of our acquaintance maintains that this method is sure to lead to the dearest possible price for castings. In his own plant he gets an allowance from the foundryman of $2.10 for every defective casting. But by the time he has machined the casting sufficiently to determine whether it can be used he has invested $9 in it. He is quite convinced that it pays him to pay more per pound for his castings in order to make sure that he gets 200 finished pedestals out of 200 castings instead of getting 190 or 192 and losing $6.90 apiece on the rejects.

Usually the higher price paid for quality materials is found to be the cheapest when the product is ready to ship. —*The Editors.*

The Sit-Down —a Boomerang?

WHITING WILLIAMS
Counsel in
Employee and Customer Relations

NEITHER government nor public appears at the moment to know just what to make of the newly invented labor tool called the sit-down or stay-in. While most local and state officials seem to consider it illegal, they nevertheless hesitate to take the logical action. At the same time it is reported that federal government heads have virtually ordered General Motors to waive its oft-stated objection and begin collective bargaining as a means of ransoming back its plants.

Meanwhile, if experience in Akron is worth anything, it looks as if labor leaders as well as employers and the public may soon be extremely sorry to have this new instrument given such notable recognition. Certainly it is highly significant that in the rubber capital where the new tool has been employed oftenest and longest, the union heads appear to have learned from experience that it is not only a dangerous buzz-saw but, worse, a plain boomerang.

One reason is that it gives the regularly elected union leaders no chance to get into the picture until after action has been taken by this or that group in this or that department—thus leaving the leaders no choice but to take over the quarrel, add a few larger and more imposing issues to make it look properly important and then do the best they can with it. Inasmuch as the original difficulties are usually departmental and individual grievances, the disturbance serves to put them very much in a jam because it gives leaders no chance to decide in advance whether the issues justify formal representation to the management or not. And few leaders fail to learn from their daily official experience that they cannot hope to gain the desired respect of management unless they screen out a lot of the complaints laid before them by their aggrieved individual members.

In several recent instances, therefore, the heads of Akron rubber unions have not only persuaded their sit-downers to evacuate but have also had their entire membership approve resolutions which in effect said: "We're sorry. We apologize—and will do our best not to let this sort of thing happen again!"

Only a few weeks ago, the leaders of one such organization expressed to management their wonderment that certain of the most incurable instigators of sit-downs were flashing excessively large rolls of money. They frankly raised the question whether the management itself was not trying to wreck the organization by having these confirmed sit-downers thus bring the union into disrepute with the majority of the workers. They further expressed the opinion that if management were not guilty, then the interruptions must be the work either of some competing employer or else of Communist "borers from within" intent on wrecking all worker organization by inducing worker anarchy and chaos.

This phase of the sit-down problem appears to have occurred to surprisingly few white-collared observers, least of all those at the head of Government. Yet every labor leader knows that he canot maintain and develop his organization unless he can convince his ordinary, typical, luke-warm, fellow-workers—those who are neither pro-union or pro-company, but only pro-*job*—that the union performs for them a service worth the monthly dues. He knows perfectly well that he cannot win these middle-ground "prospects" so long as these see the union's most ardent but least responsible members using the sit-down's power to put their fellow-workers off the job for any grievance which may momentarily occur to them. Few if any leaders worthy of the name but know that none but the most confirmed and unreasonable unionist is so blind as not to be badly affected by the following:—

Within the past few weeks in one of the Big Three rubber factories, a short sit-down precipitated a dispute which the union heads proceeded to settle with management. The agreement was found satisfactory by all except five workers in a very large department. These, accordingly, continued to sit down thus causing nearly a thousand men to hold the union responsible for the loss of three days' pay! Meantime few of those affected, and fewer if any outside, had any idea what the fuss was all about.

Or by this: Just a week ago thirty Goodrich workers by their sit-down caused the management to send home—or keep at home—its entire force of 10,000 employes. Three days later the sit-downers—by that time reduced to fifteen!—agreed, with the help of the plant union leaders, to return to work pending the later negotiation of satisfactory arrangements. The chances are that extremely few of the 10,000 had any idea of the trouble's cause, though hardly one of them but would perceive all too well its unfortunate results—80,000 man-days lost because of the organization's failure to operate the orderly procedures set up and mutually agreed upon for the purpose of insuring steady, peaceful, satisfactory work.

A Limit to Generosity

When the new device was first tried out, one of the Big Three rubber makers paid the sit-downers half-wages. ("Probably the first time in history," according to a leader, "that an employer himself paid his men strike benefits!") But today not one of the 10,000 would dream of getting a penny for the huge total of time thus lost. Certainly there is no report that the union itself paid any wages to its own clerks when these not long ago made use of this same

new tool in the union's own offices!

Today, accordingly, it is plain enough to Akron leaders that collective bargaining is impossible unless the collective bargainers can collectively control their constituents. If, further, they cannot bargain collectively, they cannot hope to obtain the members and the dues by which the organization lives.

So it is not strange that today an official representative of the C.I.O. is reported to have been spending months in Akron for the purpose of helping the union heads of a certain large plant to put an end to this new destroyer both of union control and union usefulness.

Today, most of Flint is reported to believe that its unbudging sit-downers simply refused, for their own purposes, to obey their top leaders' orders and that these leaders had no choice but to save their face by blaming their members' recalcitrance upon certain alleged short-comings of management. If this is true, then it looks as though the national leaders may later have reason to regret the failure of the federal government to help them scotch the further use of a tool so unfriendly to top control and, therefore, so unlikely to make any later agreement as to orderly, peaceful procedures worth the paper it is written on. As a matter of fact, it may well happen that the whole motor union movement may suffer hurt by the way in which the strike is said to have been started by sit-downers before the leaders desired.

Official Strike Breakers

All the above is further substantiated by the experience of the older and more successful national unions, particularly the railway Brotherhoods. More than once, the heads of these have had to outlaw locals which declared strikes "on their own" without following the processes duly set up and agreed upon with management. In some cases such leaders have had to threaten to fill the places of their own outlawed strike-members by sending in what could be called "official strike-breakers"! It is also substantiated, oddly enough, by articles in the agreement between coal operators and the United Mine Workers which regularly stipulate that whenever operations are stopped by members for any reason or by any method not specified in the contract, then every employe "shall have deducted from his earnings the sum of one dollar per day for each day or part of a day the mine remains idle."

Every experienced leader knows that the game of organization is not worth any long-run candle unless it performs an obvious service both to its members and to the employer—with both of these services completely impossible without that control and discipline of the membership which every self-starting sit-down altogether denies. Every wise leader also realizes that the sit-down negatives, above all, whatever wish he may have to deal exclusively with the central or headquarters heads of big, multi-plant industrial units. For as long as most sit-downs occur away down in some corner of a department of some local plant, 500 miles away, anything like quick satisfactory service to anybody is thereby rendered entirely unfeasible; the only place where such details can be adjusted properly is on the ground and at once. No local leader, furthermore, is likely to find his responsibility worth bothering about if he is compelled to pass the settlement of every local difficulty over to his remote central-office superior.

Reactions Likely

It requires, therefore, no prophet to predict that unless the sit-down is controlled we shall see several highly significant developments:

One of these may well be such a change in public opinion as will require Congress to demand incorporation or other government control of worker organizations. In that case, the sit-down will have served to bring about here results comparable to those nation-wide laws governing unions which followed Britain's general strike ten years or so ago. "Workmen taking physical possession of manufacturing plants," so John P. Frey of the A.F.L. has lately stated ". . . gave Mussolini the opportunity of issuing those edicts which destroyed the voluntary trade unions in Italy."

Or, secondly, the vital necessity of controlling the sit-down, may require leaders to do less leading of and more listening to, their members. Huge improvement in this connection would not fail to follow the increased willingness of labor leaders to permit and to be guided by bona-fide secret ballots; it is well known that, for instance, many locals of the miners' union have hardly experienced such a phenomenon in years!

Thirdly, continued failure of the leaders to control the sit-down is likely to persuade both government and public to come out of uncertainty and irresolution into active approval of the legal ousting of sit-downers from company premises.

Whether, however, these developments eventuate or not, the sit-down's meaning to management is clear. Inasmuch as it usually occurs in some department rather than in the plant as a whole, management has no choice but to do everything possible to enlarge the responsibilities and improve the caliber and ability of both its plant managers and also, in particular, of its departmental heads —of every one of its representatives in contact with its men.

George W. Perkins is reported to have stated thirty years ago that, "The father of the trust is the telephone." He doubtless had in mind that long distance would enable the vice-president in charge of operations to call up all his plant managers and utter not only his orders for the day but also his final decision on each and every of their reported dilemmas of yesterday. Nothing is plainer than that such a method of operating is today suicidal. The problems which separate labor and management are not the big, historical, class-wide issues so constantly heralded by the national leaders. Instead, they represent almost entirely the smaller pin-prick grievances suffered by this or that small group of individuals. If this were not true, we would be seeing instead of the present spontaneous departmental sit-downs, great plant-wide strikes called only after the thoughtful planning and statesmanship of trained, experienced leaders. Of such local pin-prick grievances, the proper treatment can never be prescribed by any executive, however expert, who sits at the end of the phone; they require the utmost closeness to that host of intangibles which every local dispute involves.

It is conceivable, accordingly, that, before it is controlled, the sit-down may not only teach labor leaders something about the necessities of control and responsibility, but also indicate to the heads of great multi-plant operations the high importance of such a tie-up between headquarters and local plant as makes it easy for local wisdom and local statesmanship to cure the local minor distempers before they become serious.

Accordingly, this new boomerang may, by means of the corrections it demands, prove, in the wisdom of the gods of industry, a blessing in disguise!

Research

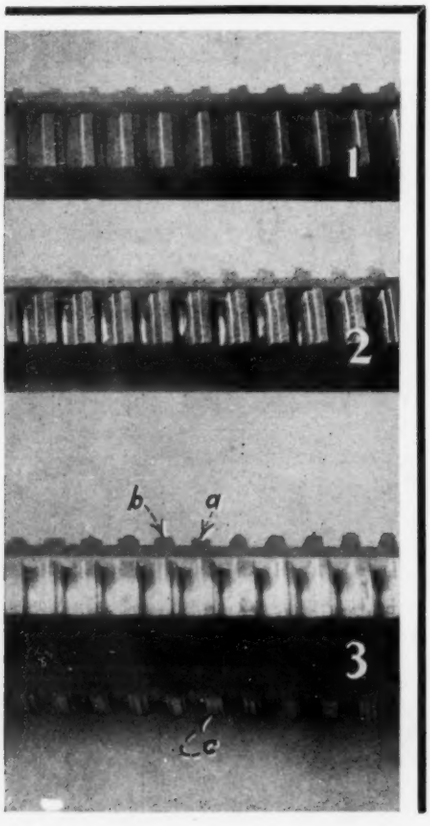
Helps Industry

DR. ING. M. KRONENBERG

SCIENTIFIC research is fundamental to future progress in the design of machine tools, but it is also useful in promoting current business. In my work as an expert before German-Russian courts of arbitration and before patent-courts of Germany I have found that research has been of great assistance in settling matters in dispute. Large amounts of money often depended on the results of these investigations.

In Germany, before the war, new machine tools were often built in response to a request from a customer who had little more than a vaguely outlined idea of his needs.

Manufacturer of tapping tool shown in upper views claimed that manufacturer of tool shown below infringed his patents (see next page)



Since the war the German machine tool industry has developed rapidly, stimulated by research in the technical universities, cooperation between industrial organizations and engineering associations, by education and professional training of operators and apprentices, and by technical exhibitions, especially those at the Leipzig Fair.

In what follows I should like to suggest some of the questions concerning machine tool developments which seem to me to be of major importance.

The question as to the best speed and feed to use seems to be simple enough, but it in reality is hard to answer, because of the great number of variables involved. Taylor designated twelve such variables, but in my opinion there are many others.

There are three major considerations: the material, the tool, and the machine. In the case of material, there are the various chemical and physical characteristics to be considered. In addition there are the matters of length, diameter and methods of holding.

As for the tools, we have everything from plain carbon steel to tungsten carbide, and, in addition, the variations in the angles involved and also in the shape of the cutting edge, whether it shall be straight or curved.

A few of the variables to be considered when a machine tool is under discussion are these: r.p.m., feeds, power, belt velocity, belt thickness, width of belt, admissible pressure on gears, admissible pressure on bearings, efficiency, admissible and required precision, method of lubrication, use of cutting lubricants, etc. In addition we must recognize such variables as the cutting speed, the area of the chip, depth of cut, width of cut, cutting pressure and the effect of vibrations. Furthermore, we have all the different kinds of metal cutting, each of which has problems of its own.

We have also the improvements in materials used in machine tools; some of them have caused many disputes. For instance: Is nickel cast iron useful and economical for machine tools? What Brinell hardness should be specified for bed-ways? Where does the danger of brittleness in the case of excessive hardness begin? Does freedom from wear and distortion depend on a high value of Brinell hardness of the bed or are there other factors to prevent distortion? For instance, accuracy and finish of the sliding surfaces running on each other.

Is it desirable to cast against chills? How to get uniform hardness in machine parts with varying thicknesses of walls and with reinforcing ribs attached to them? Will chills cause pores in the cast iron because of chemical reactions? Are some pores in the cast iron admissible? To what extent is it allowable to repair porous machine tool parts? Do such pores serve as reservoirs for lubrication of the guides, or as containers for dust and small chips that will increase the wear of the guide?

Should ways be scraped, ground or finish planed? How can we measure and express in number the quality of the surface of a way? What smoothness is suitable and where does the danger of adhesion of the sliding parts begin and for what thickness of oil film?

More Questions

How can we secure freedom from vibration with the high speeds and feeds of today? Are welded frames to be preferred to cast iron frames? Is the damping effect of cast iron helpful in suppressing vibration? Or is the addition of big masses of cast iron for the suppression of vibration too heavy a cost to pay for the results secured? What changes take place in the machine tool parts under load? Are anti-friction bearings

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Formerly Lecturer on Machine Tools at the Technical University, Berlin and sworn expert Berlin Chamber of Commerce.

better than bronze bearings for high speed machine tools?

To all these questions we may add the question of the high degree of precision that is attainable and required today. The difficulties in this direction are at once evident if we study the French contention that it is better to use dynamic tests on a workpiece at the customer's shop to prove precision of the machine tool. In Germany Professor Schlesinger's static inspection test at the builder's shop is widely used. This question has been discussed for a long time in Germany, with the conclusion that dynamic tests at the customer's shop would cause so many difficulties and would cost so much that they would not be acceptable for most machine tools. If a defect is found at the user's shop it becomes necessary usually to transport the machine back to the manufacturer's plant at prohibitive expense. There is also the loss of time involved and the danger of damage in transit. The costs to make dynamic tests are also to be taken into account. They are avoided in the static tests because no big cutting-test is made.

Weight Limit for Tests

Although the general adoption of dynamic tests at the buyer's shop as proposed by the French seem to be unsuitable, there is something to be said for the French point of view, particularly in the case of big machines and special purpose machines. In my opinion it would be wise to set a weight above which the machine tools could be tested in the user's shop and below which they should be tested in the maker's shop. This figure might be 25,000 lb. Big machine tools are usually not delivered assembled, but in parts that are put together at destination. Thus the seller has to send his assembles to the customer's plant and is able to remove minor defects on the spot, especially those that may have been caused by difficulty during transportation. Smaller machine tools are usually delivered completely assembled and there is, therefore, no need of sending assemblers with them. Consequently it is more difficult to make the precision tests outside of the manufacturer's plant.

A practical application of scientific investigation may be cited here as an example of the importance of research work to industry. This example refers to a patent dispute between two tool manufacturers.

Figs. 1 and 2 show a special tool for tapping, the teeth of which are placed in such a manner that they cut first at the right side (Fig. 1) and with the following range of teeth at the left side, (Fig. 2) while a third range is provided for cutting in the middle (not to be seen) of the groove, if the tool is rotating. Thus the groove is cut by steadily changing cutting edges with respect to the groove. A patent was granted to company A manufacturing this tapping tool.

Another company, B, manufactured the tapping tool shown by Fig. 3. In this case the cutting process takes place so that one range of the teeth (a) cuts a groove in the middle of the material; then range (b) enlarges this small groove; and finally the third tooth (c) forms the full width of the groove. If rotating, this procedure is repeated by three teeth always following each other until the depth and width of the thread are finished.

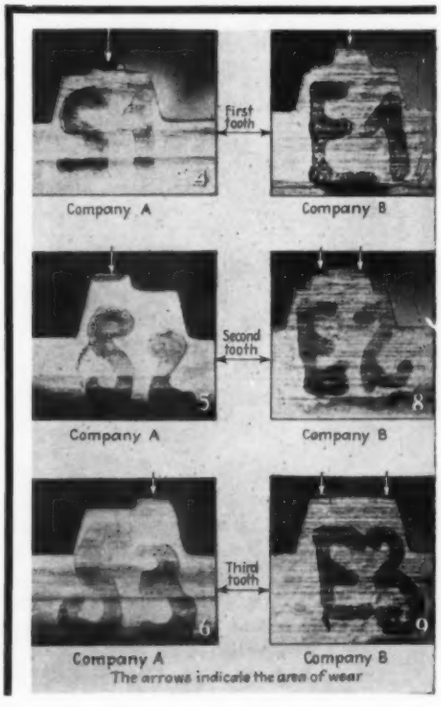
Company A claimed that Company B was using the idea of its patent. The Patent Court ordered an expert opinion. The matter was complicated by the fact that several patents were already known, which also made use of the idea of cutting the groove by means of "interrupted edges." Company B therefore claimed that it was only using that idea, thus not involving the rights of Company A.

It is naturally not possible to give here all the details of the opinion, which comprises more than 60 pages, but only to give some of the conclusions and the manner of obtaining them. It was necessary to make investigations with respect to the cutting process, which takes place with both tools. After excluding all patent ideas shown in older patents (especially that of the use of "interrupted" cutting edges which however had not found a practical application until the patent of Company A) the main point was whether the cutting was done in such a manner that the cutting pressure, the wear of the teeth, the heat conductivity, etc., were equal on the teeth following one another on both tools, thus providing a better surface, a longer tool life and permitting of a faster cutting, or if the tool of Company B did not make use of these points of view.

Figs. 4, 5 and 6 show photomicrographs of three teeth of the tool of Company A; Figs. 7, 8 and 9 of the teeth of the tool of Company B. Both tools were at first used in cutting tests, and then investigations were made with respect to the wear of the teeth. The wear can be recognized by the dark areas near the cutting edges, and was measured in more than 200 cases with help of microscopes as it amounted only up to several hundredths of millimeters. The ratio of the wear on the tool of Company A was always about $\frac{1}{3}$ on each of three teeth following one another; the same was found to be true on the tools of Company B. Thus it became evident that Company B was using the idea of the patent, although the use of tapping tools cutting partially the groove by means of "interrupted" cutting edges following one another was already known.

The investigation included also a study of the cutting capacity, comparison of the older tapping tools with the two tools in question, etc., which proved that the "progress made by the patent in question" was of a considerable degree above all what was known before it, and that this same progress was obtained by the tool of Company B by means of the same use of "interrupted cutting edges." Without scientific investigation the court would not have been able to decide whether Company B used only that which was known or that which was invented by Company A. Thus research helps industry.

Photomicrographs proved that both tapping tools used the same principle



Apprenticeship Days

CHARLES WESLOW

Think the foreman towed me around to meet the men and boys? Not on your life! He told me where to find a broom — without words I started in to learn the trade

A GOOD apprentice, if he is given quality work to do and is properly trained, will prove an asset in any shop. I would rather have a good apprentice or two working with me on my job than three or four men who have specialized on being machine operators. These men invariably do not know things apprentices are taught. I've seen men who were supposed to be first-class toolmakers go to an apprentice for information on subjects with which they should have been familiar.

At the age of twelve, being a member of a large, fatherless family, I started to work for the old Edison Lamp Works in Harrison, N. J. I worked as a laborer for almost a year and was then promoted to the position of clerk in the factory department. Later I was made messenger between the works and Edison's laboratory and became acquainted with that venerable Wizard of Menlo Park.

I strode along in the Lamp Works until I passed my eighteenth birthday and then, in 1895, I told Ma that I wanted to learn to be a machinist. Roger Owens, who lived next door, said that there was a chance for me where he was employed. He had just finished his apprenticeship.

I could have had a chance in the machine shop of the Lamp Works, but I was afraid I wouldn't learn as well there as where Roger wanted me to come. It was a long ride on a horse car to the shop where I was to learn my trade, but with my friend Roger as company, it didn't matter much if it did take us nearly an hour to get there.

The trade name of the concern was Pierce & Noble, which had moved to the outskirts of Irvington, N. J. from Newark only a few weeks before my start as an apprentice. Here they manufactured jewelers' machinery and the old Liberty printing press, which had formerly been made in New York City, under the Brooklyn Bridge. Amos Pierce acted as outside man, with a lot of political friends on the side and sports decorating his ambition. Morten Noble was superintendent and had the perseverance of a new apprentice.

The employees were made up of Bart Hunt, who is now living in Denville, N. J., as foreman, James Young as bookkeeper and about twelve workmen. Bart Hunt was of the old-fashioned type, with a kindly word for everyone.

The first day, when Roger had introduced me to Bart, he told me where to find a broom and, without words, I started in. I quickly mastered the art of donning blue overalls and a blue jumper, which Ma had decorated with a red handkerchief in the top pocket, dangling out like a Fifth Avenue dude's.

Sweep, sweep, sweep, with occasional time out to mop up the washroom—thus I contacted the men and boys ahead of me. If I had not had friend Roger to wise me up I would have soon become a fit subject for a slaughterhouse. Those guys gave me enough advice to fill an encyclopedia on apprenticeship endeavor. Ten hours?—It was like playing hookey.

After about a week of that the boss took me to the pattern shop and asked me if I knew anything about wood. I assured him that I did, having learned it from my carpenter brother; at the same time I pondered if he was sizing up my head or if I should take a good look at his. He showed me a pile of wood pieces and told me to sort them and place them on a shelf where the pattern maker could easily help himself at any time. Thus I learned economy and, incidentally, became acquainted with George Archibald, the patternmaker, who took a liking to me and gave me many helpful suggestions throughout my apprenticeship.

George and I became pals and

I would rather have a good apprentice working with me than three or four men who have specialized as machine operators

several weeks later, when he had to go to New York to hang some shafting and set up some new machinery in a jewelry factory on Gold Street, he told Bart that he would like to have me help him.

Once at this plant, out came the tools and on went our overalls. George got the scaffold ready for us to work on, and we had to chisel away at the iron girders filled with concrete to make room for a gadget to hold the hanger secure to the I-beam. Having been previously employed as a pencil pusher, here I was reaching up to the ceiling of a dirty factory and pushing out concrete with a chisel and hammer. The dirt turned my expression into one of a coal miner, but I was game. I had promised Ma that I would obey orders.

With the New York job finished after about five days of work, I returned and found myself assigned to the blacksmith, Bob Hipperlander. Bob wanted a boy to handle the sledge for him and he had to be, of course, a boy of my size. Bob initiated me into the mysteries of his busy place, a wing on the main building which contained his forge, the 25-hp. steam engine and the upright boiler.

In the Forge Shop

The initial performance consisted of grabbing the sledge handle in one hand and maneuvering it in such a way that after it was inverted I could kiss the sledge on its face. He showed me how to do it and after a little practice I became a star. He showed me how to bank the fire in the boiler, how to clean out the clinkers at noon and how to start and stop the engine.

In a couple of months I was able to forge a spanner wrench for Ma's meat chopping machine. Those brothers of mine wouldn't believe that I had forged it myself. Later I got so that I could forge a side-cutting tool or a diamond point from tool steel and also learned the art of hardening tools. Bob was very kind to me and I reciprocated by going to his shack to sing for him when he had company.

After six months in the blacksmith shop I was taken into the tool crib. Bart Hunt then gave me his personal supervision, showing me how each employee was provided with twelve tool checks which he must have in hand in return for any crib tools he wished to use. I was to hang the check onto a hook screw.

Ed Morgan, the previous tool crib boy, stayed with me for a couple of days while he operated the lathe and showed me how he made polishing lathe spindles. On this job I learned to cut threads on a lathe and it was easy to do when I cut only one side of the thread at a time as Bart instructed me.

In this connection, it may interest you young fellows for me to describe these spindles as they were made by apprentice boys in our tool crib. The firm made polishing lathes in several sizes and the spindles made in the tool crib were for the smaller size machines.

A fellow had to be extremely careful when near the finish of the turning operation not to start a cut just as the tool crib bell rang, though some of the fellows were careful not to disturb the crib boy in any way when he was on the lathe.

If the crib boy did happen to bend a spindle, he had to straighten it with a bar of babbitt metal, which he held as a crowbar under the spindle and then tapped the bent spindle with another hunk. Usually the straightening operation was postponed until there were half a dozen of them on hand to straighten. Then Bart would help.

Made of machine steel, on centers, the spindles were threaded 16 to the inch on the short end as near to the shoulder as possible without undercutting. Thus they were strong at the shoulder where they were screwed into the main spindle of the machine. One spindle had to be threaded right hand and the other left hand, since each lathe was supplied with a pair of spindles. The tapered part of the spindles was threaded 14 to the inch with a full-depth, sharp thread and they were polished with fine emery on the end of a soft pine stick. The slide rest on the lathe had to be placed at an angle of 30 degrees so that every cut was adjusted from the compound rest, which caused the tool to cut only on one side of the thread. This is the present-day practice among toolmakers who know how to run a lathe. Believe me, there are plenty of toolmakers who don't know enough to cut a thread that way. They think that a spring toolholder will take care of everything, but we didn't use a spring toolholder in threading those spindles; all we had was a solid tool made of half by 1-in. Jessop's steel. Whoever heard of tool bits and toolholders in those days?

By the time I was assigned to the tool crib I was earning $3.50 a week instead of the $3.00 a week for which I started.

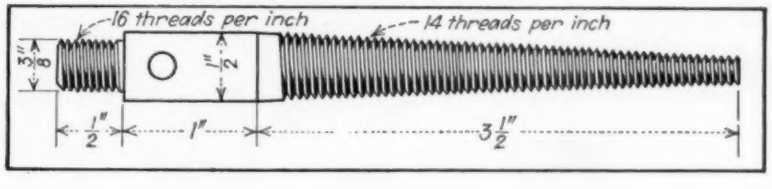
Every one of the apprentice boys was trying to outdo the others in their workmanship. I'd give five bucks for an admission ticket to see a half-dozen boys in a shop these days who would meet our standard. There used to be a half-dozen industrious brass bands to furnish the music in a fair-sized parade on any city street, but no more. Now they use drum corps who are set off by their style of marching and their uniform. No more musicians competing in a parade. Similarly, there are few apprentices competing in shops these days. As a matter of fact, the foremen in most shops don't want to bother with apprentices.

A good apprentice is a boy who is mechanically inclined, listens, and doesn't talk too much. If I owned a shop, I would have a duplicate of the tool crib in which I ran a lathe and slid out the tools called for on a check. The lathe in that tool crib was a good one, not a piece of graveyard junk and naturally the boy who operated such a lathe took good care of it.

I had three older brothers. The oldest was employed in the P. R. R. car shops operating some sort of a machine, the next younger was a carpenter, the youngest of the three learned to be a painter. These brothers had a small workshop in the yard of our home.

It was in this old shop of theirs where the carpenter brother built me a tool box, in the year 1896, and it was painted by the painter brother, whom I overheard say to the carpenter: "He'll never make a machinist." With that sarcastic remark imbedded in my memory I made up my mind that he was mistaken and did my best in my apprenticeship to prove it. I still have the box.

The apprentice in the tool crib made two of these spindles for each polishing lathe



Tops in Spinning

Men rated ace high at their trade must handle the delicate task of turning out aluminum lighting reflectors

C. H. SMITH

Supervisor of Time Study, Lighting Division, Westinghouse Electric & Manufacturing Company, Cleveland

WHEN required to produce an aluminum reflector of high quality the average metal spinner is faced with a problem entirely new in his experience. He must employ a special technique to form the metal over the chucks so that the original highly finished surface of the aluminum remains intact and free from spinning rings.

Approximately 90 per cent of the spinning work in the Westinghouse Lighting Division consists of aluminum reflectors, on many of which inspection requirements are such that any damage whatever that may occur to the inner surface causes them to be unfit for use.

Such requirements make it imperative that extreme care be used, not only during the various steps in spinning, but in all handling operations preceding delivery of the raw material to the lathes. To avoid extra handling, aluminum sheet is purchased circle sheared as nearly to the sizes required as possible. Each shipment is received packed in paper-lined wood boxes with tissue paper separators between each disk.

The containers remain closed until the material is needed at the lathes. There, the sheets are removed singly, have the center or pilot hole pierced in them on a light press provided for that purpose, and are then stacked on skids. The tissue paper kept between the blanks is then placed between the reflectors until all the manufacturing operations have been completed.

Preliminary or "break-down" operations are performed on chucks built up of hard maple, the number of operations depending entirely upon the depth and diameter of the finished part. After the break-down operations have been completed, the reflectors are placed on finishing chucks usually made of forged steel carefully machined to the contour desired in the finished reflector and highly polished. When the material has been spun tightly against this polished surface, any slight imperfections that may have resulted from the use of the wood chucks are ironed out, leaving a reflecting surface of glass-like smoothness. Chafing of the material against the finish form, as a result of the pressure applied in spinning, is prevented by the application of petroleum jelly or heavy oil to the chuck before each blank is spun.

The material must not be allowed to slip on the chuck at any stage of spinning for the reason that roughness of the inner surface is almost sure to result. To prevent any tendency to slip or creep, three center holes are used instead of the conventional single hole. These holes are pierced to match three similar holes in the tail block and three pins in the center of the chuck. When the blank is in place on the chuck, with the tail block against it, there is no possibility of its turning.

As shown in the illustration, the spinning lathes are individually motor driven. Each one is powered with a 5-hp., d.c. motor of 500 to 2000 r.p.m., connected with the spindle by chain belt and geared in such manner that spindle speeds of 250 to 1700 r.p.m. are available. Speeds are controlled by means of the large rheostat shown below the headstock. This is a distinct advantage over the belt-driven, cone-step pulley, because it is possible for the spinner

to change speeds at will to suit the various diameters of any chuck.

The smaller of the two rheostats shown is used for controlling the stopping time of the spindle. This is necessary, since when the button is pressed to stop the motor, the dynamic brake is applied and the machine is stopped instantly, often with the disastrous results of unscrewing a heavy chuck from the spindle and throwing it to the floor. By means of the rheostat, the large steel chucks may be brought to a gradual stop, while the smaller ones, being much less likely to unscrew by centrifugal force, may be stopped more quickly.

In spinning the average reflector, three spinning tools are used—two sizes of cone point tools and one large oval iron. These are made of a good quality of steel, hardened and polished to a high degree of finish. Tools of other metals and even wood or hard fiber have been tried, but those of steel are the only ones that do not have a tendency to seize and scratch. Hard red fiber may be used with fair results when it is not necessary to work the metal down tightly to the form.

Good Lubricant Needed

Since the peripheral speeds used in spinning aluminum range from 500 to 3,000 ft. per min. the need for an effective lubricant is quite obvious. Considerable experimenting has been done with various substances known to be satisfactory on other metals. However, for this type of work, a half and half mixture of petroleum jelly and ordinary yellow laundry soap has proved superior to all others.

This lubricant is prepared, first by slicing the soap into a container with the petroleum jelly, then placing over a moderately hot fire until thoroughly dissolved. When cooled, the result is a jelly-like substance that may easily be applied with a stiff brush or the end of a tightly rolled bundle of cloth.

All the points brought out in the foregoing need not be observed except in that class of work where high quality of finish is the first consideration. Other spinnings may be produced with but few more precautions against damage than are used for other metals, and with the same equipment. As a rule, also, much higher speeds may be used where a first class finish is not needed.

In conclusion, it may be said that when a metal spinner approaches the point where he is capable of producing an aluminum reflector of the high quality demanded today for industrial and commercial illumination, he has really reached the top of his class.

"Stepped" Dimensions for Jig Boring

III — Eleven examples show applications of the principal formulas required to make detailed layouts of the work

C. W. HINMAN

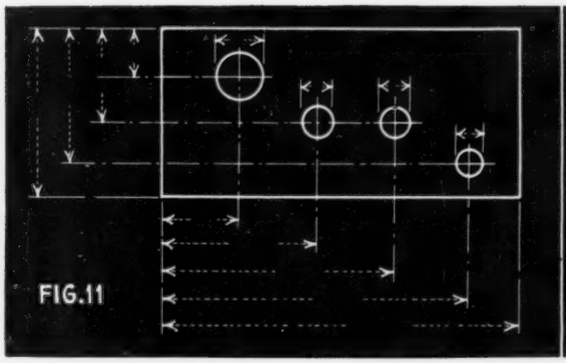
WHEN dimensioning rectangular work for the jig-boring machine, "stepped dimensions" are preferable. The left-hand edge and the top edge of the work, or convenient center lines, are taken for the zero line from which each dimension is individually established for locating accurate points on the work. Sometimes a combination of these systems is used. For example: An edge of the work may be assumed as the zero line for either the vertical or horizontal dimensions; while a parallel line is taken for the zero line in cross dimensioning. Similar to the given key words in a cross-word puzzle, the dimensions are given down and across, or vertical and horizontal.

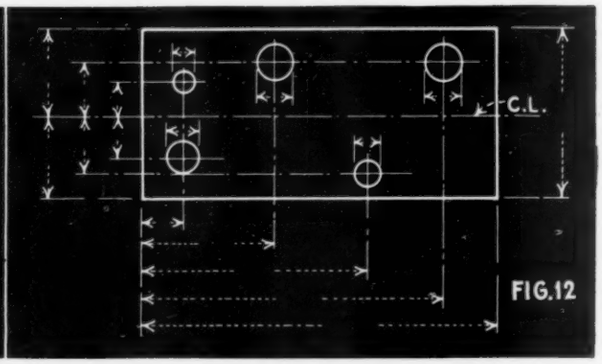
The advantage in using this system is the registration of each working point on the piece from a common line, and in saving the jig-boring machine operator's time in figuring. If it did nothing more than this, the system would save enough to more than pay its own way, but when, in addition, it eliminates the cumulative errors caused by lack of common registration, it greatly increases its usefulness. It further helps in changing dimensions easily without interfering with the others.

Fig. 11 shows the usual method adopted in "stepped dimensioning," while Fig. 12 shows a combination layout using an edge and a parallel center line. A final check is that the sum of all the differences between consecutive dimensions, added to the first or least dimension, is equal to the last or greatest dimension.

For circular work, the steps are given in degrees of arc, as shown in Fig. 13. To find the step dimension in degrees, minutes and seconds of arc between holes equally spaced around a circle, divide 360 deg. by the number of spaces, which gives the degrees in each division. The remainder in degrees is multiplied by 60 and divided by the number of spaces to give the minutes in each division. Likewise the remainder in minutes, multiplied by 60 and divided by the number of spaces, gives the seconds in each division. The remaining seconds, if any, are distributed equally in each step.

Since the advent of jig-boring machinery, a need exists for reliable tables giving the degrees, minutes and seconds contained in the equal divisions of circles. The tables should be compiled up to 1,000 equal divisions or more. Television scanning disks will be needed in commercial quantities some day, and some of them contain over 4,000 holes,





Two variations of the "stepped dimensioning" system for jig boring are in common use

equally spaced and on many diameters.

The contour openings in blanking dies consist mostly of round holes, or of circular arcs connected by straight lines. A jig-boring machine is therefore useful in boring "sweeps" for the arcs, and incidentally removing a part of the tool steel in the openings. In square or angular corners of a die opening, holes are bored with circumferences tangent to the adjacent sides of the corners, for the purpose of subsequently roughing out the contour of the die in a vertical shaper, and then "finish filing" to line. In using this method in a jig-boring layout, it is better to specify large holes, but not so large as to cut into other holes, or to overlap into another part of the die outline, and thus spoil the work.

A common example of this is shown in Fig. 14. The given dimensions are shown, while the unknown dimensions X are wanted for jig-boring purposes. C = cot of angle 42 min. 30 min. times 0.0625 in., or 1.09131 $\times$ 0.0625 in. = 0.0682 in., and 0.2070 in. — 0.0682 in. = 0.1388 in. for dimension X.

The same problem may appear in different guise, as shown in Fig. 15. This sketch is a small part of a large jig-boring layout for a die that blanks one of the openings in an automobile dash-board bezel. The given dimensions are, A, B, C and R, while angle E and dimension X are wanted. Tan angle $E = (A - C)/B$, and $X = C - \tan\ (90 \text{ deg.} - \left[\frac{E + 90°}{2}\right]) R$.

If A = 1.346 in., B = 1.096 in., C = 1.284 in., and R = 0.149 in., angle E is 3 deg. 14 min. as found by the first formula. By substituting this value in the formula for X, we obtain 1.1432 in. Another method, easier to handle, follows: Cot D = $\cot \frac{(E - 90°)}{2}$ = cot 46 deg. 37 min. = 0.9451. Therefore D = cot $D \times R$ = 0.9451 $\times$ 0.149 = 0.1408 in. Then X = 1.284 — 0.1408 = 1.1432 in.

Punch clearances are provided by adding the over-all clearance to the diameters of the holes. If 0.006 in. clearance is used, the hole, $2R$, or 0.298 in. in diameter, should be specified 0.304 in. diameter, and 0.003 in. added to dimensions A, B, and C, while dimension X would obviously remain unchanged.

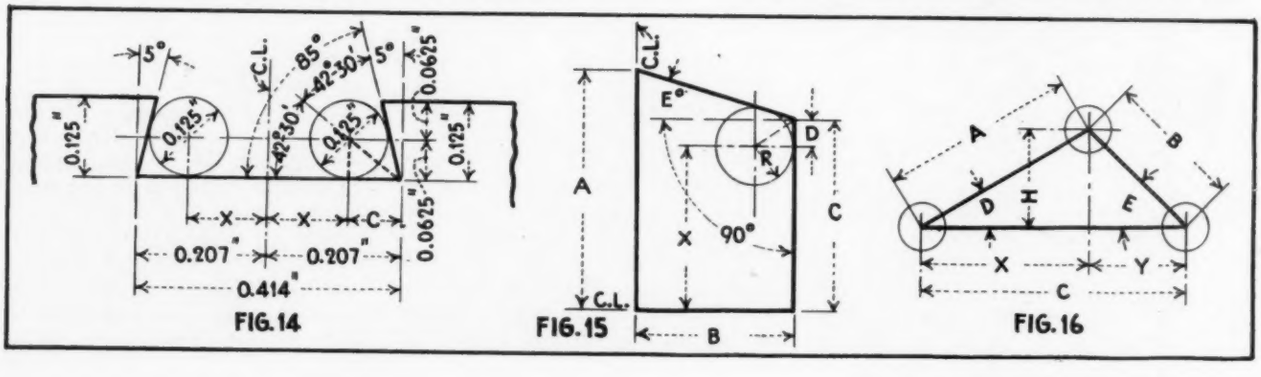
Another problem is to find vertical and horizontal dimensions between three given gear centers, Fig. 16. Dimensions A, B, and C are given, and H, X and Y are to be found. $X = A^2 - B^2 + C^2 \div 2C$. And $Y = C - X$, and $H = \sqrt{A^2 - X^2}$. If angles D and E, and side C are known, then $H = C$ divided by the sum of the cotangents of angles D and E. This is an important and useful formula in shop trigonometry, as will be shown in the next problem.

A typical example in jig boring a die opening is presented by Fig. 17.

Fig. 13—For circular work the arcs are "stepped" from a common reference point O

In both examples, dimension X must be found in reference to a center line or edge to facilitate jig boring

Before the three holes can be jig bored, the vertical and horizontal dimensions must be found



The given dimensions are *A*, *B*, *C*, *D*, and *E*, while the diameter *X*, and the stepped dimensions *F*, *G*, *H*, and *J* are wanted. *A* = 4.250 in., *B* = 2.000 in., *C* = 6.250 in., *D* = 1.4531 in. and *E* is taken at 0.500 in.

The difference between dimensions *C* (6.250 in.) and *A* (4.250 in.) is 2.000 in. or *S*. D (1.4531 in.) divided by *S* (2.000 in.) gives the tangent of angle *L* (0.72655) which corresponds to 36 deg. Angle *M* = 90 — 36 = 54 deg. The difference between dimensions *B* (2.000 in.) and *D* (1.4531 in.) is 0.5469 in. or *Q*. *Q* (0.5469 in.) divided by *C* (6.250 in.) is the tangent of angle *T* (0.0875) which corresponds to 5 deg., and 90 deg. minus 5 deg. is 85 deg. for angle *P*. Angle *K* = (180 — 36) ÷ 2 = 72 deg. Angle *N* = [180 — (54 + 85)] ÷ 2 = 20 deg. 30 min. Hypothenuse *W* is found by multiplying *S* (2.000 in.) by secant of 36 deg. (1.2361) which gives 2.4722 in. And *W* divided by the sum of cot 20 deg. 30 min. (2.6746) and cot 72 deg. (0.32492) is 0.8241 in. or *R*. *R* (0.8241 in.) times 2 is 1.6482 in. which is the required diameter of hole *X*.

E (0.500 in.) divided by 2 is 0.250 in. for dimension *H*. Cot *K*, (0.32492) multiplied by *R* (0.8241 in.) gives 0.2678 in. for dimension *Y*. Dimension *A* (4.250 in.) minus *H* + *Y* (0.5178 in.) is 3.7322 in. for dimension *J*, and *R* (0.8241 in.) minus 0.250 in. is 0.5741 in. for dimension *F*.

For computing dimension *G*, refer to Fig. 18 which is an exaggerated enlargement showing the conditions clearly. Angle *O* is found by dividing (90 deg. — 5 deg.) by 2, and adding 5 deg. which makes 47 deg. 30 min. Z is found by multiplying tan 47 deg. 30 in. (1.0913) by 0.250 in. to give 0.2728 in. *B* (2.000 in.) minus *R* (0.8241 in.) is 1.1759 in. and the difference between 1.1759 in. and Z (0.2728 in.) is 0.9031 in. or dimension *G*.

Fig. 19 represents a typical layout for jig boring the holes in a round die block. Eight 0.068 in. diameter holes are given at the corners of the arc openings, as are the three radii, and the dimension 1 1/16 in. The angles are found by dividing 0.7187 in. by 1.672 in., which gives the sine of the angle 25 deg. 27 min. 30 sec. For the rectangular opening, angle *E* corresponds to the tangent found by dividing *A* by *B*. $R = C/\cos E$, and $r = B/\cos D$. Proof: $R^2 = A^2 + C^2$, and $r^2 = A^2 + B^2$.

A case that comes up frequently in the shop is given in Fig. 20 wherein *B* = *A* × 0.70711. Of course, 0.70711 is both the sine and cosine of 45 deg.

For solving the diameter of an inscribed circle touching three sides and within 45 deg. angles, Fig. 21, *D* = *C* × 2.4142. For solving *D* similarly inscribed within any equal angles, Fig. 22, *D* = cot (*A*/2) × *C*.

The examples presented are not hypothetical cases, but are practical problems and solutions taken from recent practice.

Part IV of Mr. Hinman's series, to appear in an early number, will also cover shop mathematics.

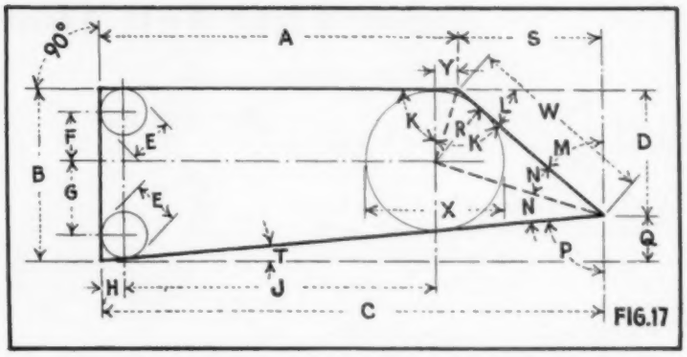


FIG. 17

By a series of calculations, four stepped dimensions essential in jig boring a die opening are found

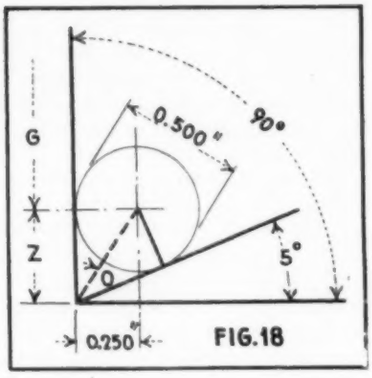


FIG. 18

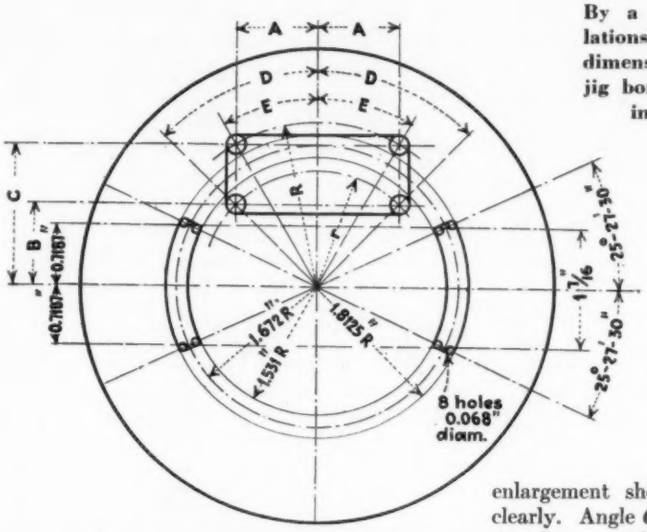


Fig. 19—It is necessary to calculate the angular displacement of the holes in relation to a reference line, in order to know how much to index

These three problems have occurred recently in the shop

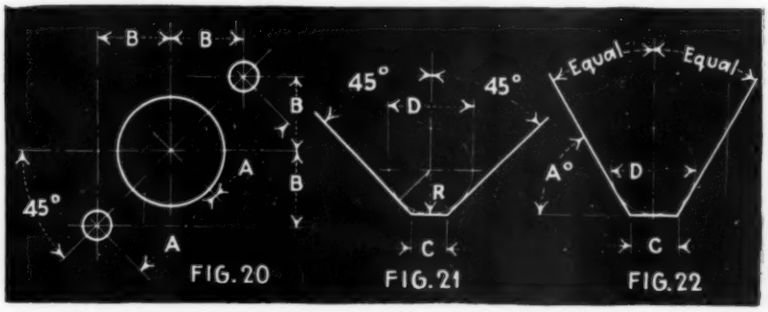


FIG. 20 FIG. 21 FIG. 22

Axles That Tell Their Own Story

FRED H. COLVIN
Editor

AXLE performance is such an important factor in railroad work that it is necessary to have a reliable record of axle service. To secure such a record without undue trouble and cost, and with a minimum of stenciling of axles, the New York Rapid Transit Corporation has devised a code method whereby each axle carries its own history. This method makes it possible to give the name of the maker, his heat number, the serial number of the axle and the date of machining.

Two sizes of letters are used, 5/8 in. and 3/8 in. The letter *O* is omitted in both cases, which gives 25 letters, (and numbers) in each set. In addition both sizes of letters do double duty by being underlined with a straight mark as in the table. As this shows, the 5/8-in. plain letters run from 1 to 25, the 3/8-in. from 26 to 50. When underlined the 5/8-in. letters represent 51 to 75 and the 3/8 in. 76 to 100.

KEY TO NUMERALS AND SIZE OF LETTERS

5/8"		3/8"		5/8"		3/8"	
A	1	A	26	$\underline{A}$	51	$\underline{A}$	76
B	2	B	27	$\underline{B}$	52	$\underline{B}$	77
C	3	C	28	$\underline{C}$	53	$\underline{C}$	78
D	4	D	29	$\underline{D}$	54	$\underline{D}$	79
E	5	E	30	$\underline{E}$	55	$\underline{E}$	80
F	6	F	31	$\underline{F}$	56	$\underline{F}$	81
G	7	G	32	$\underline{G}$	57	$\underline{G}$	82
H	8	H	33	$\underline{H}$	58	$\underline{H}$	83
I	9	I	34	$\underline{I}$	59	$\underline{I}$	84
J	10	J	35	$\underline{J}$	60	$\underline{J}$	85
K	11	K	36	$\underline{K}$	61	$\underline{K}$	86
L	12	L	37	$\underline{L}$	62	$\underline{L}$	87
M	13	M	38	$\underline{M}$	63	$\underline{M}$	88
N	14	N	39	$\underline{N}$	64	$\underline{N}$	89
P	15	P	40	$\underline{P}$	65	$\underline{P}$	90
Q	16	Q	41	$\underline{Q}$	66	$\underline{Q}$	91
R	17	R	42	$\underline{R}$	67	$\underline{R}$	92
S	18	S	43	$\underline{S}$	68	$\underline{S}$	93
T	19	T	44	$\underline{T}$	69	$\underline{T}$	94
U	20	U	45	$\underline{U}$	70	$\underline{U}$	95
V	21	V	46	$\underline{V}$	71	$\underline{V}$	96
W	22	W	47	$\underline{W}$	72	$\underline{W}$	97
X	23	X	48	$\underline{X}$	73	$\underline{X}$	98
Y	24	Y	49	$\underline{Y}$	74	$\underline{Y}$	99
Z	25	Z	50	$\underline{Z}$	75	$\underline{Z}$	00

Two numbers can be represented by each letter which, in the case of numbers having an odd number of figures, are spaced off in twos beginning at the right. Thus a heat number of 75630 would be represented by three letters, small E for 30, an underlined large F for 56 and a large G for 7, as $GF_E = 75630$. When the second or fourth digit from the right is zero, space from the left by twos.

A separate set of code letters is used to represent suppliers' names.

The complete information, such as

Maker—Carnegie
Heat number—75630
Serial number—32183
Date—Oct. 1935

would be stamped as follows:

$$C \quad GF_E \quad CV_H \quad J_J$$

giving a complete history of the axle that will be visible as long as the axle is in existence. The key to the numeral system is given herewith.

Hobbing Small Reamers

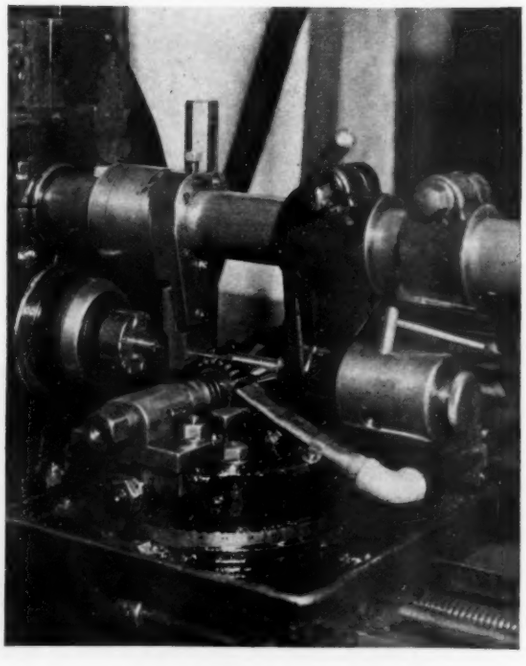
HOBBING flutes in reamers shows a trend in modern machining methods. It not only reduces the cost of reamers but requires only a minimum of machine equipment in the tool room. The illustration shows the way in which reamers are hobbed in the tool room of the National Cash Register Company, Dayton, Ohio. This is one of two Barber-Colman machines that have been fitted up specially for this work.

Follower Rest Used

The whole work head is free to move on the column, either when it is lowered by hand to the cutting depth, or raised automatically when the cut is completed. The hand lever and its linkage is shown at the top of the head. A substantial overarm carries the follow steady rest that supports the small reamers during the hobbing process.

A large bushing slides on the supporting arm and an adjustable bushing holder is attached to the sliding bushing. This in turn, is attached to the tool carriage by means of an adjustable upright. In this way the supporting bushing is just ahead of the hob at all times, giving maximum support.

The reamer being hobbed is driven by a spur center and the tail center is spring actuated so as to maintain constant pressure. Cooling lubricant is forced on the cutter through the flattened pipe shown. When the hobbing is completed the head is automatically tripped, raises out of the cut and returns to the upper position which permits easy loading of the next blank.



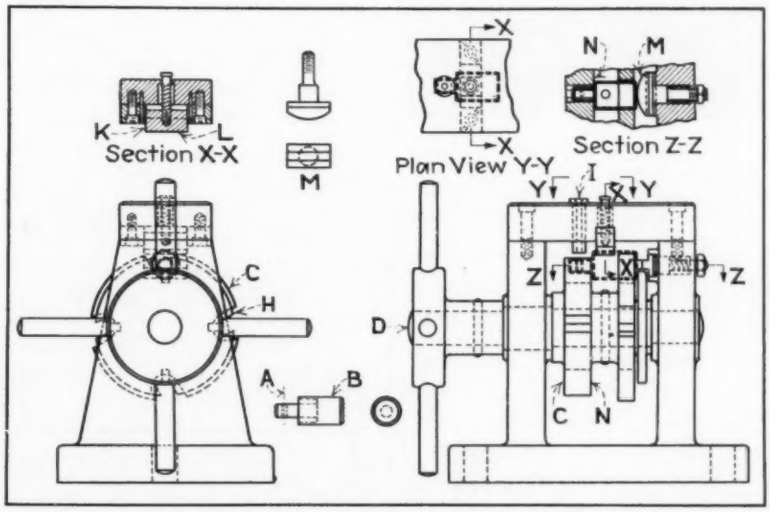
Ideas from Practical Men

Jig for Drilling Valve Stems

CHARLES C. TOMNEY
Chief Tool Designer, Carrier Corporation

Illustrated is a jig for drilling the ⅛-in. hole *A* in the brass valve stem *B*, its features being that the work is automatically clamped and unloaded, and the index plunger is automatically engaged and disengaged.

The work holder *C* is rotated on the shaft *D* by the pilot wheel *F* and has four pockets *H* for holding the work. The pockets are at an angle so that when the work is inserted at in pocket *H* at the right and the work holder is indexed to bring it under the bushing *I* by rotating the pilot wheel counter-clockwise. As it approaches drilling position it contacts the spring-actuated plunger *K* having a rounded groove at *L* of the same radius as that of the work, as shown in section *X-X*. When the work reaches drilling position it engages the groove *L* in the plunger and is held by pressure of the plunger spring. Also, the inner end of the work contacts the rounded head of the spring pressure pin *M*, section *Z-Z*, and its shoulder is forced against



In indexing, the work is located in drilling position by engaging a groove in a spring-actuated plunger and is located endwise by contact with a spring pressure pin

the loading station it will not fall out of place, and after it has been drilled and while the work holder is being indexed it will fall out by gravity. At the bottom of each pocket is a slot that serves for better seating of the work and for chip clearance.

In operation, the work is inserted the inner edge of the work holder at *N*, locating it endwise.

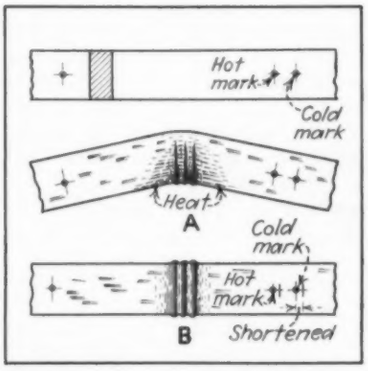
After a stem has been drilled and as the next one is being brought into position by indexing, the drilled stem is approaching position *O*, but due to the angle of the pocket, it has dropped out by gravity.

Connecting Rod Shortened by Bending

F. M. A'HEARN

In erecting a machine, a connecting rod of rectangular section was found to be ⅛ in. too long. Since there were jaws with finished pin holes at both ends of the rod, the ordinary blacksmith method of shortening by "jumping" or "staving" did not appeal to the erector, so the job was done in the following way:

The middle of the rod was heated on one edge, the opposite edge being but slightly reddened. When the heated edge was at a forging heat the rod was bent edgewise, as at *A*, com-



By alternately heating the edges of the rod, and bending and straightening the rod edgewise at each heat, it was shortened the required amount

pressing the metal at the hot edge while the cold edge resisted stretching. When the rod had partly cooled, the cold edge was heated to a forging heat and the rod was straightened, as at *B*, compressing the metal at the hot edge.

Before the rod was heated, a light punch mark was made at the left and, with a tram in that mark, the "cold mark" was made at the right. When the first edge was heated, and before bending, the "hot mark" at the right was made by another tram. The cold mark was for a permanent reference when the rod had cooled after the bending and straightening

operations. The hot mark was used to check the operation without waiting for the rod to cool.

When the rod was at about the same heat as that when the hot mark was made, the change in length was checked by the tram in the cold mark and was found to be close enough. When the rod was cold, the tram in the cold mark showed how much the rod had shortened. The ridges of the wrinkles made by bending and straightening were filed off. The mechanic who did the job said that with a little practice it was not hard to get a closer job than by the blacksmith method.

Grinder Backrest With Indicator

J. R. WHITTLES

When a backrest for a cylindrical grinder is equipped with a dial indicator, the latter can be used to tell the progress of the grinding and when the work has been ground to finished size. The indicator is thus used instead of depending upon the micrometer graduations on the cross-feed handwheel.

Plunger *A*, which serves as the backrest, is threaded into the body of the device and is adjustable to suit the diameter of the work. Inside the plunger is the rod *B* which operates the indicator *C* through the connecting arm *D* and the adjusting screw *F*. The arm is held in the vertical position by the pin *H* engaging an elongated hole. In the inner end of rod *B* is a diamond to prevent endwise wear, the rod being normally held so that the diamond is out of contact with the work by the light spring *I*. When the diamond is to be brought into contact with the work, the operator presses his thumb against the lower part of connecting arm *D*, compressing the spring and moving the rod forward.

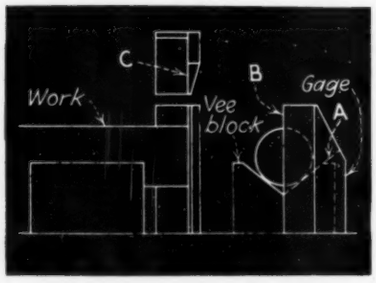
This movement presses the end of the adjusting screw *F* against the spindle of the indicator, which indicates the condition of the work as to finished size. Screw *F* is, of course, so adjusted that the indicator will read zero when the work has been ground to finished size.

The device is attached to the machine table by the pivoted clamp *K*, which is operated by the screw *L* having a knurled head.

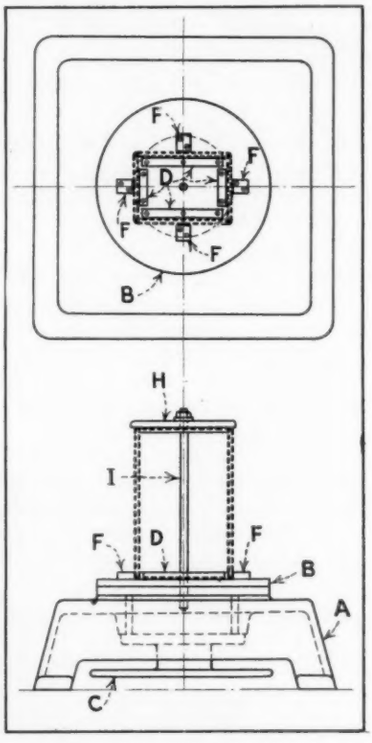
V-Block Center Gage

F. MUIR
Hamilton, Ontario, Canada

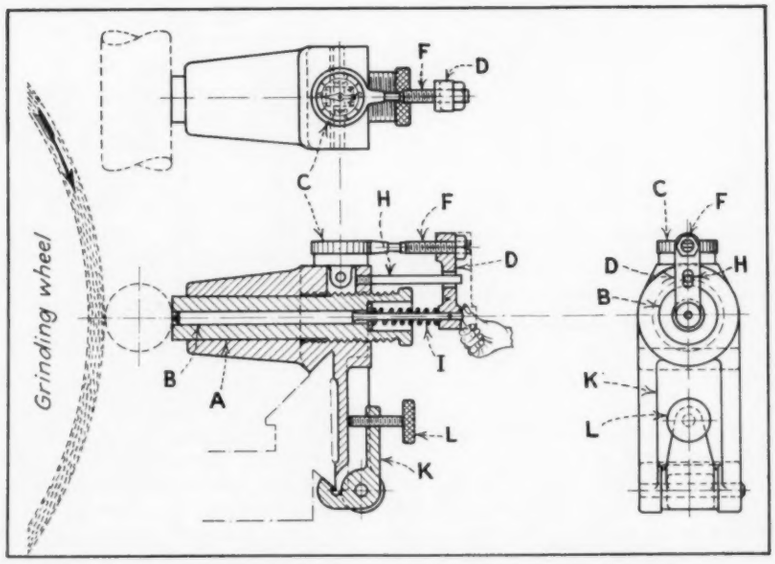
The center gage shown will enable the user to strike a center line across any size work held in the V-blocks it is made to suit. It has a tapered face *A*, the same height and taper as the V-blocks. It is beveled down to a thin edge *B*, which is the exact center of the block. With its aid, it is the work of a moment to scribe right-angle lines across any size shaft within the capacity of the V's. The end of the work is a little beyond the V-block so that the gage can be brought up to touch on faces *A* and *C*. A scriber, run down face *B*, marks the center.



This V-block center gage packs away nicely in the tool kit



Plates forming the sides of the work are stood on end on the turntable, being located by blocks and held in position by shouldered clamp H



Indicator C is used to find the diameter of the work as grinding progresses, instead of depending upon the graduations on the cross-feed handwheel

Welding Fixture

FRANK HARTLEY

A fixture is shown for holding a box-like assembly while the corners are being welded. Essentially, it consists of the base *A;* the turntable *B;* the handwheel *C* by which the turntable can be rotated; the blocks *D* and *F* for locating the work; the shouldered clamp *H;* and the long bolt *I* for the clamp.

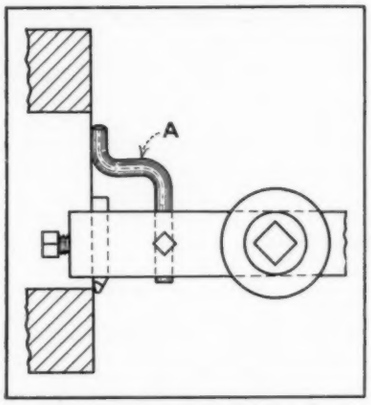
The four plates forming the sides of the work, indicated by heavy dotted lines, are stood on end on the turntable, being positioned by the blocks *D* and *F* and held in place by the shouldered clamp *H*. After the first corner has been welded, the operator rotates the turntable to bring the next corner into convenient position for

welding, alternately rotating the turntable and welding the corners until the work has been completed quickly and neatly.

Back-Stop Boring Gage

H. MOORE
Hamilton, Ontario, Canada

When many holes of the same size are to be bored in work in an engine lathe, it is common practice after the last cut has been taken on the first piece, bringing the hole to size, to set the micrometer ring on the cross-feed screw to zero and to use that setting in making the finishing



After finishing the first hole, the stop is brought into contact with the back of the hole and the micrometer ring on the cross-feed screw is set to zero

cuts in succeeding holes. But the toolbit will wear slightly at each cut, and it must be taken out of the holder for sharpening from time to time, so that the micrometer ring must frequently be reset.

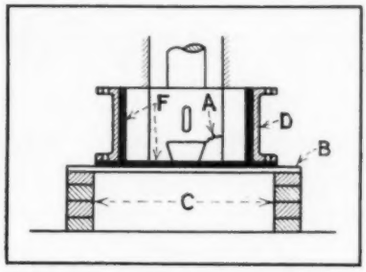
The back stop *A* set in the toolholder, as shown in the illustration, will eliminate the necessity for resetting the micrometer ring. After the first hole has been finished to size, the back stop is brought into contact with the back of the hole and the micrometer ring is set to zero. No matter what position the point of the toolbit may be in, the progress of the operation can be watched by bringing the stop into contact with the back of the hole and reading from the micrometer ring how much more is to be taken off.

If, for example, when the stop is brought into contact with the back of the hole, the zero mark shows that the hole is 0.010 in. under size, the tool must be brought into contact with the front of the hole and then moved 0.010 in. for the cut that will bring the hole to size.

Molten Iron Removed Seized Hammer Tup

J. T. TOWLSON
Enfield, Middlesex, England

The tup of a half-ton steam hammer had to be replaced because of a fracture at *A* in the dovetail. All



Molten iron poured into a flask surrounding the tup provided enough quick heat to expand the hole and free the tup from the piston rod

efforts to remove the tup by ordinary means were without avail.

Finally an iron plate *B* was blocked up from the anvil with bricks as at *C*, and on it was laid a hinged foundry flask *D* large enough to surround the tup with space to spare. The inside of the flask and the top of the plate were well luted with fireclay, as at *F*, and a couple of ladles of molten iron were poured into the flask.

After waiting until the iron had cooled just beyond the plastic state, the bricks were knocked out from under the plate, and the plate, flask, iron and tup fell on the anvil.

Straightening a Die Plate

CHARLES WESLOW

In the sketch *A* is a cold-rolled die plate 6 in. wide, 1 in. thick and 18 in. long. Seldom does cold-rolled steel come from the mill perfectly flat. In this case, the die plate was twisted, but the sketch shows how to straighten it easily.

The plate is fastened to the cast iron die shoe. To take the twist out of the plate, the latter is mounted at one end on *B*, which is a piece of cold rolled ½ x ¾ x 6 in. long, and is held there securely with a good strong C-clamp *C*, right onto the cast iron die shoe, which happens to be plenty thick enough for such an operation. The other end of the plate is mounted on one corner only on top of a piece of cold rolled *D* ½ x ¾ x ¾ in. and is merely resting there, while a strong C-clamp *E* is screwed down with nothing under the plate at that corner. The screw is given a certain number of turns with a big wrench and loosened again, and if the plate is not twisted back to a true plane, the whole works is replaced for another try at it by screwing the clamp *E* down further, and so on until the plate is flat.

The cast iron shoe sure will bend in the operation, but nothing in comparison to the plate, since the shoe is 3 in. thick while the plate is 1 in.

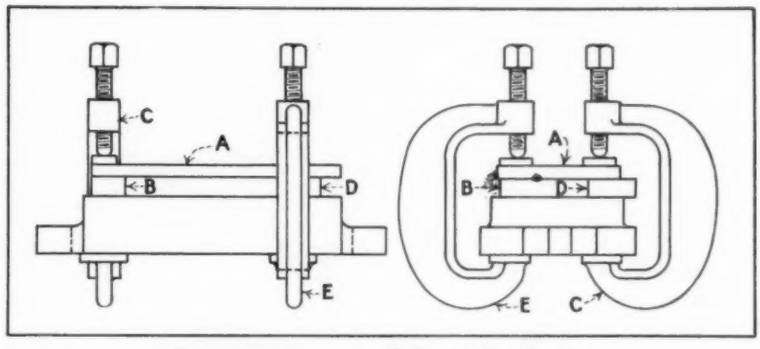
Incidentally, the plate is for holding tool steel piercing hole bushings, some 35 or 40 of them. The die shoe had no holes drilled in it yet, when this straightening operation took place. Thus it was very strong.

Old Mike Becomes A Lathe Stop

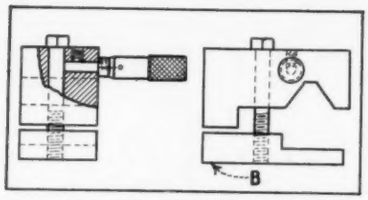
R. W. NANTAIS
Maintenance Man,
Universal Button Company

A job held up for want of a lathe stop was put through by making one from cold-rolled steel and the thimble, barrel and spindle from an old pair of micrometers.

A piece 3¾ in. long was cut from a 2-in. square cold-rolled bar. In this block a ½-in. step was shaped, and a V cut to fit the outside way of



Two C-clamps correctly applied take the twist out of a piece of cold-rolled steel



Less than 2 hrs. was required to make this lathe stop, utilizing parts of an old micrometer

the lathe. From the side a ¼-in. hole was drilled in the block to take the spindle of the micrometer. A clamping piece, ¾ x 2 x 3½ in., is likewise stepped to slip under the lathe way. The block is then drilled for the ⅜-in. clamping screw and the clamp drilled and tapped for a ⅜-in. thread.

A Test's the Thing

There's nothing like knowing that any device will stand the punishment for which it was designed, plus of course, the necessary factors of safety. And there is no way of knowing positively about such matters except an actual test of the device.

To prove the load carrying capacity of their hoists and cranes the Shepard-Niles Crane & Hoist Corporation tests each one with dead weight loads, before shipment. These loads consist of test blocks of widely varying weight. They are built up of slabs of known weight which have projecting ears for holding them in a yoke by which they are lifted. Test loads of different weights can be readily built up to meet any condition desired.

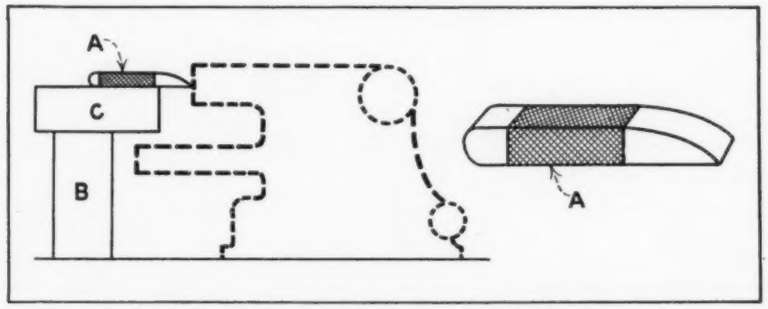
Scribing Tool

JAMES W. EMMONS

I have found the tool illustrated to be very helpful in scribing layout lines on work where a scribe block cannot be placed against the face of an odd-shaped piece.

In scribing a line on the bracket indicated in heavy dotted lines, the tool *A* is placed on parallel blocks of the correct height, as at *B* and *C*, and the line is scribed as shown. Both the work and the parallel blocks are placed on a surface plate.

Other features of the tool are that a heavier and deeper line can be scribed than by the scriber used in an ordinary scribe block; the marking edge will last longer between sharpenings than that of the conventional scriber; it can be grasped more firmly than can a scriber; and placed on parallel blocks of the correct height there can be no error of measurement as with a height gage.

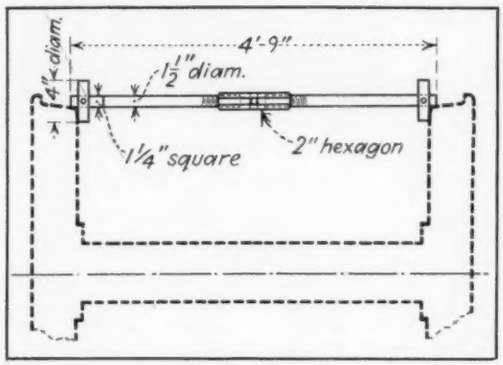


For laying out work of odd shape, this tool has advantages over the conventional scribe block

Gage for Checking Driving Wheels

J. J. THOMPSON

Part of the daily routine of roundhouse mechanics is checking the driving wheels of locomotives for parallelism and distance between faces. The weight of modern locomotives and the speed at which they must run to keep up with schedules make it imperative that special attention be given to the condition of their driving wheels. Despite heavy construction and close clearances, it is very difficult to keep all the driving wheels "tracking" properly.



Correct use of this gage will show the parallel relationship of any pair of driving wheels

Due to the terrific strains in rounding curves at high speeds, axles may sometimes be bent, or the side pounding of the wheel hubs against the boxes may spread the driving wheels slightly apart. These conditions can be shown by gaging or tramming the inner faces of the wheels at three equidistant places and finding the distance between the inner faces of different pairs of wheels.

For checking for the results of these conditions, the gage illustrated was made and has proved to be very satisfactory. It consists of two rods; two collars; and a turnbuckle.

In use, the gage is placed with the collars between the inner faces of a pair of wheels and the turnbuckle is turned until the collars contact the wheel rims. The checking is repeated at two other places about 120 deg. apart, giving an accurate reading of the parallel relationship between the wheels. If the different pairs of wheels are not the same distance apart, it shows that some of them have been spread.

Tool Shelf for the Lathe

H. L. WHEELER

A simple convenience that is lacking on many machine tools is a suitable place for the operator to keep his small tools, such as mikes, calipers, scales, etc., where they will always be in convenient reach and still out of the way.

In one shop this problem was solved in a simple and inexpensive way by providing a shelf similar to the one illustrated for each lathe. It is made of sheet metal and a piece of ¼x1¼-in. bar stock.

The shelf may be of any required surface area and height to suit conditions. The support is bent as shown in the sketch and the upper part is spot-welded to the under side of the shelf. The foot is attached to the right rear wing of the carriage by a bolt in the T-slot.

A shelf for small tools is quite a convenience to the machine operator

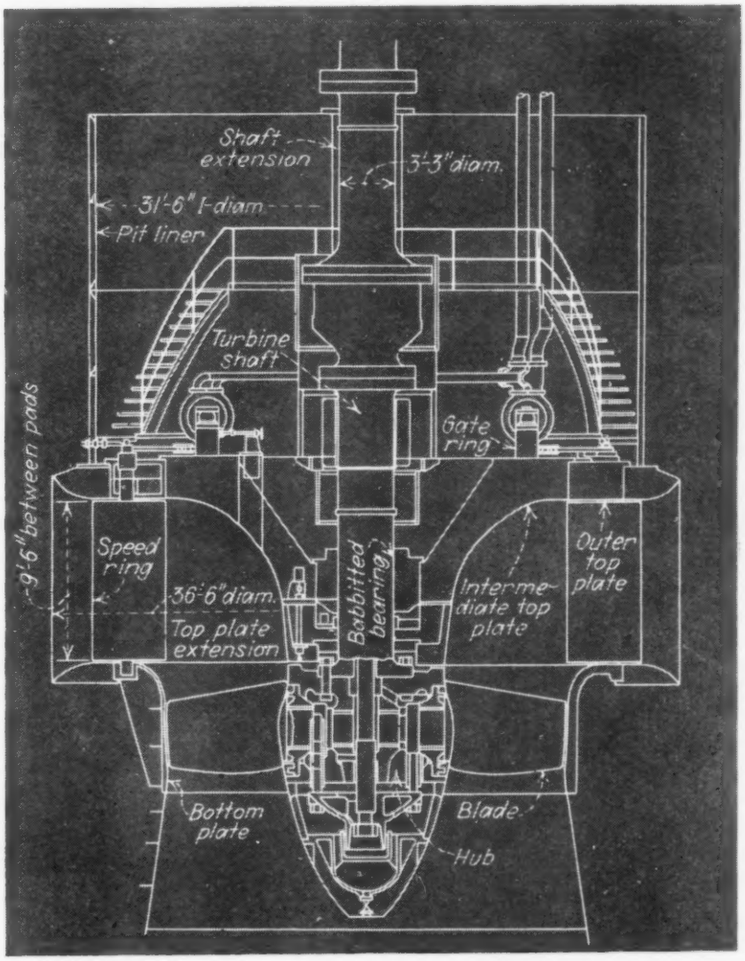
Flame cutting and arc welding used in fabricating main turbine members, provide the world's highest-powered Kaplan Turbines with increased strength and greater dependability

Giant Turbines *for Bonneville*

CURTIS W. LAU
Welding Department
S. Morgan Smith Company

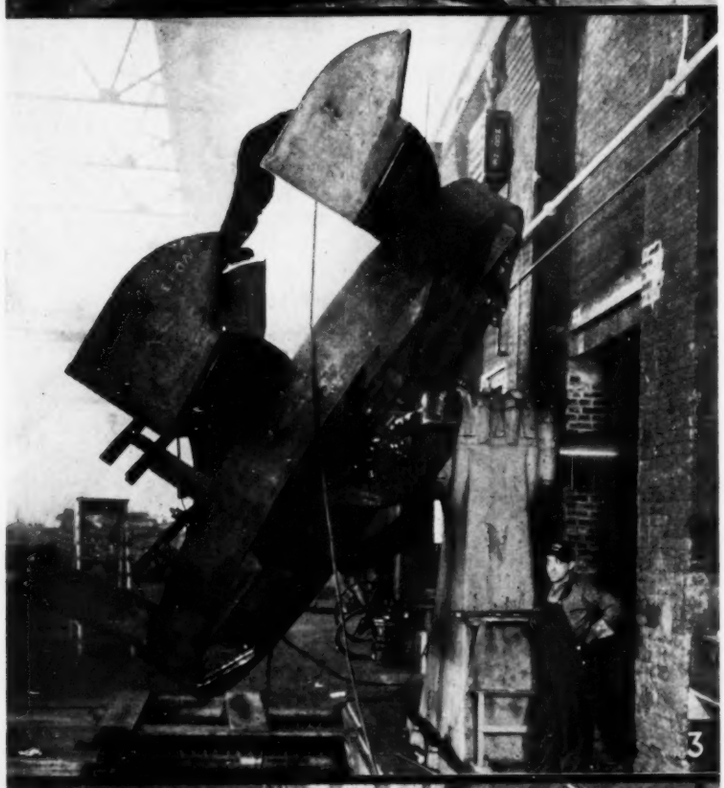
THE KAPLAN adjustable-blade turbines built by the S. Morgan Smith Company for the government's Bonneville Dam project, located near Portland, Oregon, are rated at 60,000 hp. each, under an effective head of 50 ft. with a generator capacity of 48,000 kva. The maximum operating head is 65 ft., and the corresponding capacity 66,000 hp. The fact that they are the highest-powered turbines of their type ever built anywhere is sufficient to make them objects of interest. But the feature that may attract the attention of those interested in shop practice is the welding problems involved and how they were successfully solved.

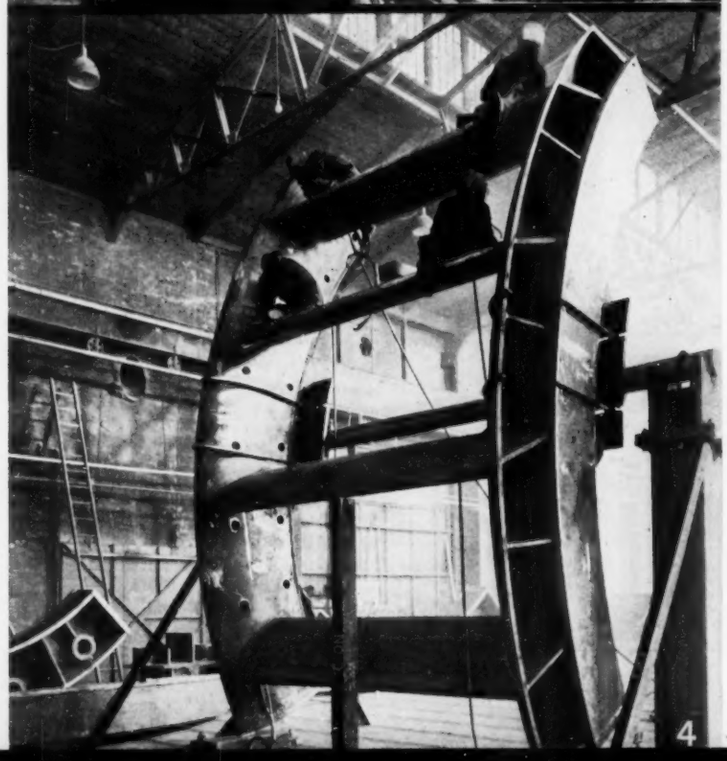
***Fig. 1*—A cross section through one of the 60,000-hp. units shows the location and relative size of the various parts**



Some idea of the magnitude of these Smith-built turbines is to be gained from Fig. 1. An even clearer picture is obtained when one considers some of the over-all dimensions. For example, the diameter of the five-bladed propeller type runner is 23 ft. 4 in. while that of the turbine shaft is 39½ in. The over-all height from the bottom of the runner deflector to the top of the unit is 89 ft. 5¼ in. The largest outside diameter is that of the speed ring, which measures 36 ft. 6 in., and the height of the water passage through this part is 9 ft. 6 in. The weights of some of the turbine parts are staggering. The speed ring weighs 177,000 lbs., and the complete top plate, built in three sections, totals 232,500 lbs.—or more than 116 tons of steel plate in this part alone. But as this article is dealing with unusual welding, it is important that we examine the various welded parts and the reasons for making the change from past fabrication methods.

It is interesting to note that this is the first time that the oxy-acetylene flame and metallic arc have ever been called upon, to such an extent, in the manufacture of hydraulic turbines. This development is natural, however, since the replacement of castings by rolled steel is one of the most valuable accomplishments of arc welding. The many advantages of a welded design over cast iron or cast steel are well known. Suffice it to say that had it been necessary to cast the larger sections of these tur-





bines, it would have been a difficult task to prevent cores from floating and to hold the sections within allowable tolerance. More than likely some of the castings would have had to be discarded and recast.

Even after going through such a procedure, it is possible that machining would uncover hidden defects causing further delay. Such delays are especially costly when the job is on a strict contract, and a heavy penalty is forfeited for each day that it is behind schedule. When considering this change in fabrication technique, however, the thing that influenced the S. Morgan Smith Company more than any other single factor was quality. Turbine parts produced as a result of this change are beyond a doubt far superior and more dependable than could have been hoped for had they been cast.

There are eight major welded members on the turbines for Bonneville which when assembled form the wheel casing and related parts. For handling and shipping, these various units were designed in sections, bolted together at the joints, and are known as the speed ring, outer top plate, intermediate section of the top plate, top plate extension, bearing housing, pit liner, gate ring, and bottom plate. Before the final design of the turbines was approved, a fourth scale plate steel model of the most critical of these sections was fabricated and tested under conditions producing loads and stresses identical to those which will be experienced in the field. This was accomplished by using various types of extensometers to indicate deflections and determine the location of reinforcing members. For the sake of convenience and to save time, the most important characteristics of the major welded parts are given in table form on page 178.

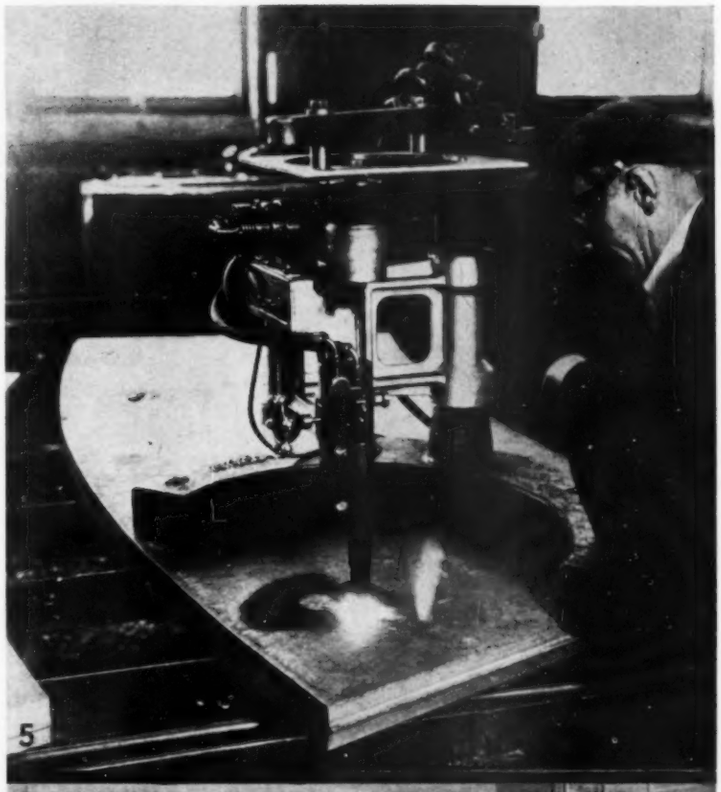
***Fig. 2*—A radiagraph flame cutting machine was used to form the ends of the guide vanes**

***Fig. 3*—Two sections of the upper part of the speed ring were mounted on the large positioning machine, with the table tilted, to weld the fillet between the flange and circular plate**

***Fig. 4*—Four welding operators welded the vanes to the upper and lower rings with the speed ring section mounted on a shaft positioner and blocked in place**

The speed ring, sometimes called the guide ring because it contains guide vanes, leads the water from the concrete scroll case through the wicket gates into the runner. These vanes also act as a series of columns carrying about 9,000,000 lbs. under the most severe condition of loading which occurs when the scroll case is unwatered. They are made with two 1¼ in. plates, hot formed to the proper shape and welded to a nose piece machined from bar stock. The formed plates were trimmed and beveled for welding, using a mechanical flame-cutting machine known as a Radiagraph. After the vanes were completely welded, on the floor, their ends were formed to fit the upper and lower parts of the speed ring by again employing the use of the Radiagraph, Fig. 2. The track of the cutting machine was set at right angles to the vane and parallel to its transverse center line. The blow pipe was then inclined to form the angle which the vane makes with the speed ring and was manually operated in the vertical and lateral directions to follow a layout line as shown. The piece was cut from both sides in this manner, after which the edges were beveled for welding, using a hand torch. This method produced the required shape, a cut of high quality, and was both fast and economical.

The upper and lower sections of the speed ring are made of steel plate varying in thickness from 1 in. to 3 in. Fig. 3 shows two one-fifth sections of the upper ring being welded on a large welding positioner which was built by the S. Morgan Smith Company. The machine has a capacity of 25 tons and consists of a



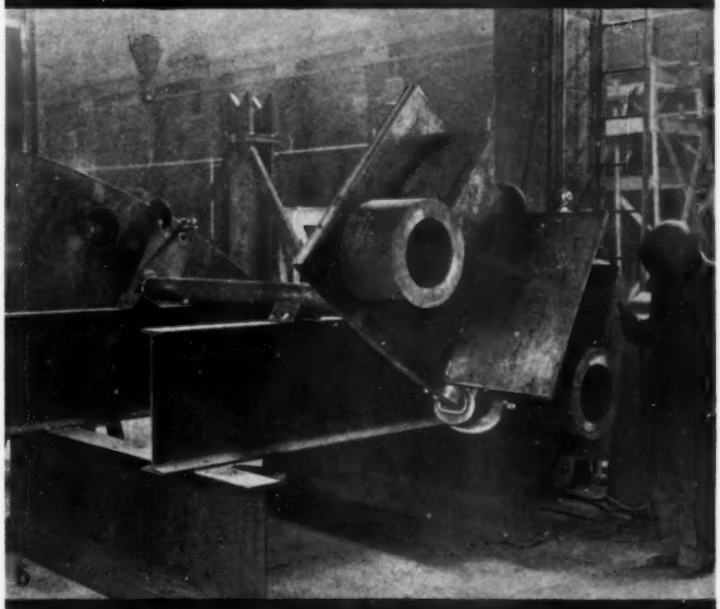


***Fig. 5*—Various shaped holes were cut in the outer section of the top plate with the magnetic roller of the Omnigraph machine guided by a cam**

***Fig. 6*—A horizontal shaft, rolling on two I-beams, was used to position the individual sections of the outer top plate while completing the fillet welds**

***Fig. 7*—Guided by a radius rod, the Radiagraph made circular cuts on 3¼-in. steel for the intermediate section of the top plate; in the cut nearest the camera, note the way the centerpunch marks have been nipped in half by the cutting flame**

TABLE OF CHARACTERISTICS

MAJOR WELDED PARTS — SMITH-KAPLAN TURBINES FOR BONNEVILLE ONE UNIT.

Welded Part.	Wt. of Part Before Machining.— Pounds.	Thickness of Plate Used.— Inches.	No. of Sections Per Part.	Outside Diameter. Feet.	Inside Diameter. Feet.	Height. Feet.	Linear Feet of Gas Cutting.	Linear Feet of Welding.
Speed Ring.....	177,000	1–3	5	36.5	28.83	12.75	2,920	3,850
Outer Top Plate.	106,800	1–3½	4	30.79	23.5	2.29	1,050	1,630
Inter Top Plate..	111,250	1–3¼	2	24.46	5.75	8.48	1,750	1,760
Top Plate Extension.....	14,485	1–3	1	10.04	5.54	3.69	400	360
Babbitted Bearing.....	10,300	1–3	2	6.54	3.33	3.71	240	210
Bottom Plate....	130,000	1–3½	2	29.75	23.13	7.66	1,300	1,500
Gate Ring.....	21,300	1–3¼	2	20.08	17.0	1.75	430	800
Pit Liner.....	81,400	¾–1⅝	12	32.25	31.5	20.25	.....	1,930
Totals.....	652.535	....	....	.....	.....	.....	8,090	12,040

vertical table 14 ft. in diameter, built of structural steel, mounted on the end of a solid forged steel shaft. This assembly is supported on two bearing housings. The table is mechanically rotated, remotely controlled by a push-button, and can be manually tilted back through an angle of 45 deg. for positioning fillet welds. A welding pit beneath the table allows large pieces which extend below the floor line to be rotated.

In general, the procedure in welding the upper and lower parts of the speed ring was to assemble the flange and inside circular plate together with the ribs and bolting flanges. This was done by placing a full size sketch on a cast iron floor plate and assembling the sections according to the sketch—a method which proved to be fast and at the same time accurate. After the sections were completely welded in this stage, they were again placed on the sketch for checking purposes. Very little change was noticed. The formed plate which covers the skeleton obtained by the method just described is 1¼ in. thick and was made in two sectors of approximately 36 deg. each. After being welded together to form one section, the resulting cover was assembled on the ring, tack welded in place, and the pieces returned to the large positioning machine where the welding was completed.

All of the various parts making up these rings were cut according to a layout on the steel plate by the mechanical flame cutting process. This is true of all the welded parts for Bonneville. The weld bevels were also cut in the same manner with the exception of the heavier plates where machined U-type bevels were used because of their greater economy. The general procedure was to use the U-type groove on plate thicknesses of 1½ in. and upward, and the V-type groove for plate thicknesses under 1½ in. In a few instances machined edges were also used where a perfect fit was absolutely essential.

At this point a most serious problem was encountered—how to weld the upper and lower ring sections together with the guide vanes in such a way that the different parts would be in the proper relation to one another. The probable effect that distortion would have on the finished

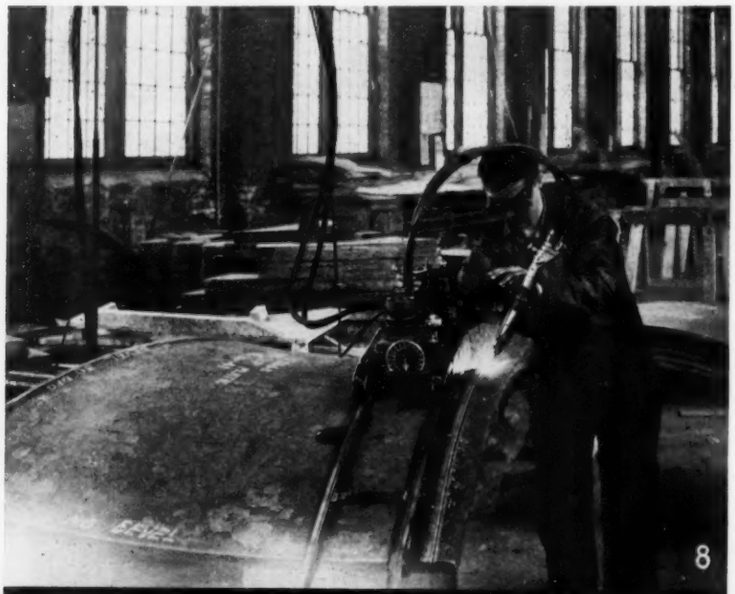


***Fig. 8*—Formed plates for the intermediate section of the top plate were set up on a pivot while the operator trimmed them with a track-guided Radiagraph**

***Fig. 9*—A quarter unit of the intermediate section of the top plate was placed on the large positioning machine for welding operations prior to putting on the formed plates**

speed ring section only increased the problem. To be sure of getting sound welds, the piece had to be positioned, but was too large for the positioning machine. All of these problems were successfully overcome with the aid of the improvised shaft positioner, Fig. 4.

After locating the vane positions on the crown plates of the upper and lower ring section, using a templet made especially for this purpose, the one-fifth unit of the speed ring was assembled and rigidly tacked together to insure safe handling. The section was then placed on the shaft positioner by bolting the upper and lower parts to two saddles supported on a steel shaft. In this way the piece could be turned completely around the shaft, using a crane, or supported from the floor in any desired position.

The speed ring sections obtained by this method of fabrication were carefully checked as to physical dimensions. A much greater degree of accuracy was obtained than could be expected with a cast design. Machine work was reduced to a minimum, it being necessary only to machine the bolting flanges and bearing surfaces for the final assembly. Another noteworthy feature is that the five speed ring sections were completely machined individually instead of by the usual practice of machining after assembly as a unit.

The top plate serves as a cover over the runner compartment and as previously mentioned is built in three sections. The outer part of the top plate is built in quarters and contains the upper gate stem bearings which are of forged steel welded in place. The cover of this section is of 3½ in. plate containing a number of oval holes for packing gland adjustment and a series of circular holes for the upper gate stems. These holes were flame cut, as shown in Fig. 5, using an Omnigraph flame cutting machine. A small hole was first pierced through the plate near the edge of each opening by means of an oxygen lance. This hole provided a means for starting the cut. A steel cam was made for each of the different shaped holes, and a magnetized roller on the cutting machine followed the outline of the cam reproducing its shape through the medium of a torch mounted on a swinging hinged arm. The cuts produced in this way are smooth and square with sharp corners at both the top and bottom edges of the plate.

A small four-ton capacity motor driven welding positioner was used in welding the rectangular and triangular ribs to the 2½-in. lower plate, using ¾-in. fillet welds. After completing this operation, two of these sections were bolted to opposite ends of a shaft, Fig. 6, which rolled on parallel I-beams. The clamping was done in such a way that the two sections balanced each other and at the same time provided work for two welders. In this position, the fillet welds between the ribs and the gate stem bearings and the grooved welds between the gate stem bearings and the lower plate were completed.

After welding these individual parts they were further assembled and tack welded until they formed complete quarters with the exception of adding the 3½-in. cover plate. The sections in this stage were clamped on large positioning machine to complete all of the welding except that involving the cover plate. Checking the physical dimensions of the finished sections proved them to be remarkably accurate. In general, it was found more practical to hold the large sections for Bonneville against distortion than it was to keep welded pieces of lighter construction within reasonable variations.

The intermediate section of the top plate is funnel shaped, thus di-

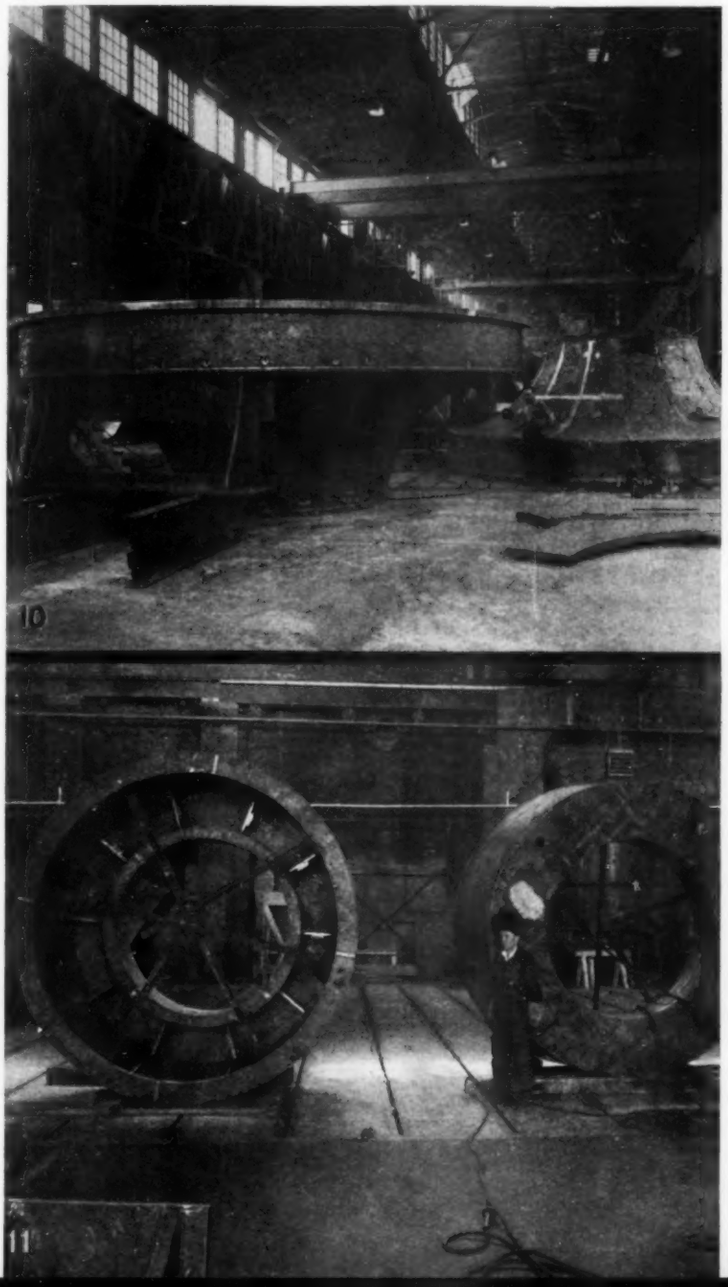


***Fig. 10*—Two sections of the intermediate top plate for Bonneville weigh 111,250 lbs. or more than 55½ tons**

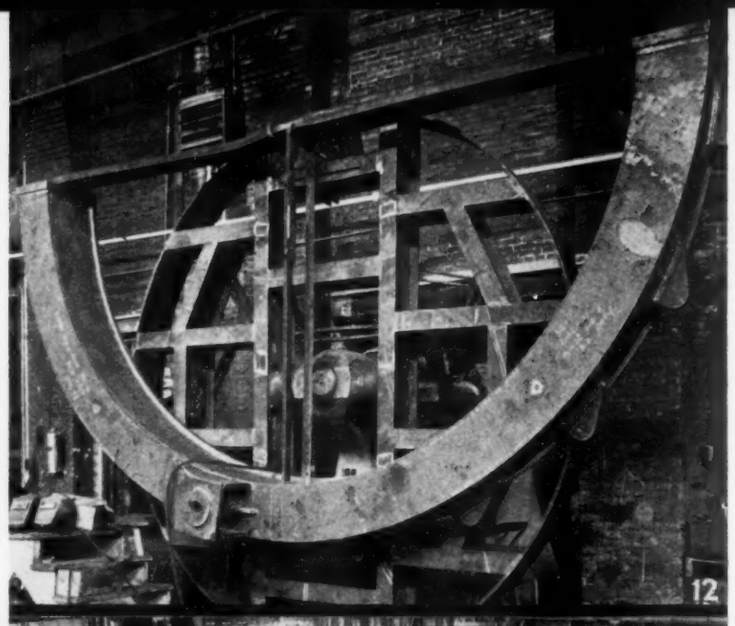
***Fig. 11*—The top plate extensions were fabricated entirely on the floor by rolling and laying them flat to secure the best positions for welding**

recting the water in a downward direction. This part, built in two sections, was handled in approximate quarter sections until practically all welding was completed before joining the pieces to form halves.

Fig. 7 shows a Radiagraph flame cutting machine making circular cuts in 3¼-in. steel which will form the cover of the intermediate top plate. The cutting speed for this particular operation was approximately 8 in. per min. with the oxygen pressure at the regulator set at 45 lbs. per sq. in. The same machine was used to cut the 2¾-in. end flanges, but in this case the irregular curved cut was formed by using a side roller attachment on the machine, guided by a heavy rolled bar iron templet. The quality of the cuts produced by this mechanical flame cutting process was comparable to a rough machine cut.

The outer shell of the intermediate section of the top plate is of 1¼-in. hot formed steel plate. This shell was built in sections welded together at the seams. The edges of the sections which formed the joints were cut off at an angle of 30 deg. so that when two plates were placed together they gave an included angle of 60 deg. for butt welding. In trimming the formed plates a Radiagraph was used with a flexible track. The job was set on a pivot, Fig. 8, so that the operator could tilt the plate as the machine moved along, keeping it climbing slightly to assure the even motion so essential to good gas cutting.

The general procedure in welding the intermediate section of the top plate was to assemble, tack and completely weld the frame in quarter sections. Fig. 9 shows a quarter section being welded on the large positioning machine. After they were completely welded in this stage, two quarter sections were placed together on a cast iron floor plate while the formed plates were fitted and tacked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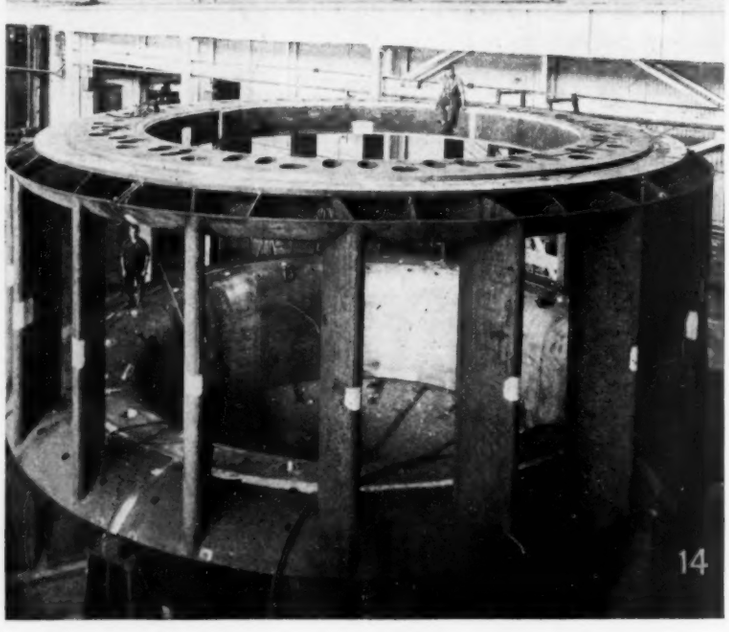
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***Fig. 12*—A half-unit of the gate ring was placed on the large positioning machine to weld the long circular grooves on the inside and outside of the piece**

***Fig. 13*—A craneman's view of the S. Morgan Smith erection floor shows three-quarters of the pit liner in the foreground**

***Fig. 14*—Together the outer top plate, speed ring, and bottom plate weigh almost 207 tons**

in place. Then the half unit was separated, and the sections returned to the positioning machine where the formed plates were welded to the frame. Following this the two quarters were again placed together and this time securely tacked to form a half unit. The remaining welding was done by positioning the piece on the floor, using a crane. Fig. 10 shows a shop view of two sections (one unit) of the intermediate top plate weighing 111,250 lb. Some idea of their physical size can be gained by comparing them with the man in the picture. These members and all the other major welded parts for the Bonneville turbines, with the exception of the pit liner, were stress relieved before being machined.

Positioned on Floor

The top plate extension bolts to the bottom of the intermediate top plate and, when assembled, contains a packing gland which prevents the water from seeping around the shaft and back of the cover. Because this part was built as a unit it could be rolled on the floor to position most of the welds while those remaining were such that they could be welded with the pieces lying flat. Fig. 11 shows how efficiently these parts were handled.

Supported in the small opening at the bottom of the intermediate top plate, the bearing housing serves to steady the turbine shaft. It was built in two sections and is quite small when compared with some of the parts just described. The welding problems involved, however, were very similar, and the part after being machined, babbitted, and grooved, was pleasing to the eye.

As the name indicates, the pit liner is a steel lining or form for the concrete surrounding the turbine pit. It includes a doorway, platforms, and stairs, giving access to the various parts contains two servo-motor bays which support hydraulically operated servo-motors supplying the necessary power to operate the wicket gates. The pit liner deserves mention because of its physical size. The inside diameter of the part is 31 ft. 6 in., and the height is 20 ft. 3 in. It is two sections high while the circumference has six joints, giving a total of twelve sections per unit. Fig. 12 shows a shop assembly of the part.

Mounted on the intermediate section of the top plate, the gate ring transmits the power supplied by the servo-motors to the wicket gates. This is accomplished through two push-and-pull rods connecting it to the motors, and a system of gate arms and levers connected to the wicket gates. As the ring is moved by the action of the motors, the wicket gates can be completely opened, completely closed or held in any position between open and closed. In Fig. 13, a half unit of the gate ring is shown being welded on the large positioning machine. Practically all of the welding except the long circular grooves on the inside and outside of this part was done on the floor previous to this operation.

The bottom plate, sometimes called the throat ring, houses the runner and contains the lower gate stem bearings. The outermost part of this section, where the gate stem bearings are located, is of cast steel welded in place. This is the only instance where a casting was used in conjunction with any of the welded turbine parts for Bonneville. In general design the bottom plate is somewhat similar to the intermediate top plate, except that the shell in this case is on the inside of the frame instead of on the outside as was the case with the intermediate section of the top plate. In both cases the members were built in half sections which made the handling and welding problems much the same. Fig. 14 shows a shop assembly of the bottom plate, speed ring, and outer top plate. Note the magnitude of these assembled sections which have a combined weight of 413,800 lb.

Approximately 776 tons of rolled steel plate varying in thickness from ¾ in. to 3½ in. were required to build the major welded parts for the Bonneville turbines. The work involved more than 16,000 linear feet of machine gas cutting, 24,000 linear feet of welding, and 29 tons of welding electrodes were used.

Machine gas cutting, although presenting many difficult problems new in the field of mechanical flame cutting, produced unusually satisfactory results. The quality of the cuts made by the process was excellent and the work was done with a tremendous saving in cost.

The welding on the turbines for Bonneville is unusual both from the standpoint of the size of the welds produced and in that practically all of these welds were positioned so that each operation was done in a downward direction. This last feature is an especially unusual one when the physical characteristics and weights of the parts which had to be handled are taken into consideration. In welding by positioning much time is utilized in handling the job, but the time consumed in this way is more than regained in the welding operation and in the saving in weld metal.

Generally, in any accomplishment, it is necessary to sacrifice one quality in order to obtain another. In architecture beauty is often sacrificed for function, in machinery efficiency is sacrificed for speed, and in many businesses today quality is sacrificed for greater production. But in building the turbines for Bonneville Dam, just the opposite was true. Not only was production speeded up, greater strength and dependability achieved, but a higher degree of quality was obtained with a saving in weight.

Bandsaws for Steel

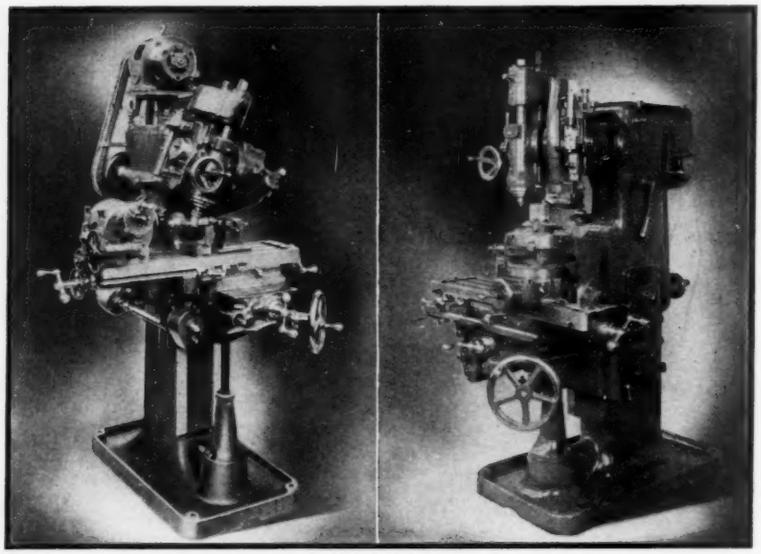
C. G. WILLIAMS

SOMEONE said in "Toolroom Aids" (*AM*—Vol. 80, page 1008), that "Bandsaws for steel for cutting out dies and other purposes are comparatively new in the toolroom." This statement causes me to think that he was born since 1900, or else he would know that there is nothing new under the sun.

In that year in Philadelphia we had some long steel plates that were to be formed to a shape made up of several segments of circles, no two of which were alike. It would be a long slow job to shape each and then file them to a true contour, so I made use of an old bandsaw that stood in one corner of the shop. Pulleys were changed to speed up the old machine to what the manager said was past the danger point. The old saw blade was reversed, bringing the back against the work, where upon we had a very efficient friction saw.

We placed one of the big flat plates on the table, arranged to force it against the saw blade and then watched the sparks fly. It only took a few minutes to saw out the contours and the cuts were generally closer to the line than if the shaper had been used. The friction saw was a far more common sight in those lays than now.

Shop Equipment News



"Cobly" milling and shaping machine with motor mounted on head, left, is shown set up to cut helical gears. The machine at the right has the motor mounted on the floor and is here set up to shape an irregular punch, using the radius tool attachment

"Cobly" Universal Vertical Milling and Shaping Machine

The No. 14 "Cobly" universal, vertical milling and shaping machine, offered by Cochrane-Bly Co., 15 St. James St., Rochester, N. Y., has been improved by mounting a high-speed spindle on the head and by the provision of a radius tool attachment in place of the clapper block on the shaping head. The milling and shaping heads adjust to any angle right or left, from vertical to horizontal and 45 deg. front and back from center for drilling, milling, boring, shaping and slotting operations. Constant power feed is provided for milling and boring and an intermittent feed is provided for the shaping operation. These feeds apply to longitudinal, transverse and circular table movement. The table can be arranged to receive a 10 in. universal dividing head, and a wide variety of work can now be done on this universal vertical machine.

The high-speed spindle is mounted in anti-friction bearings and provides ten right-hand speeds with a maximum of 2,100 r.p.m. It is equipped with a sleeve to hold split collets from $\frac{1}{8}$ to $\frac{5}{8}$ in., thus eliminating the need for a high-speed attachment. Power down feed with four changes for each spindle speed can be furnished for this spindle. The feed has an automatic stop and a micrometer screw for gaging depth.

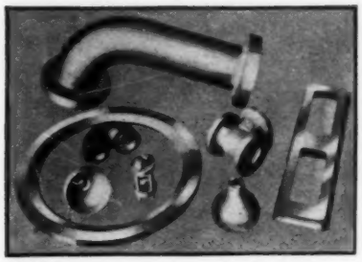
The table is provided with means for mounting end gages, micrometers and dial gages reading to 0.0001 in. for accurate setting of the table for jig boring and similar operations.

Radius tool attachment, now used in place of the clapper block formerly provided, will shape punches from the rough without undercutting. A punch located on the compound circular table can be machined on all sides and from any center within a 5 in. circle, developing true radii, tangent and angular cuts with a high degree of accuracy. These table settings can be duplicated when machining the die opening with a regular toolholder. The radius tool attachment will operate on a cutting stroke from $1\frac{1}{2}$ to $4\frac{1}{2}$ in.

The table has a longitudinal feed of $18\frac{1}{2}$ in., and a transverse feed of 9 in. Vertical adjustment of the table is 18 in. Table, inside of oil pockets, is 9x29 in. The machine requires a floor space of 57x66 in. and net weight is approximately 2,100 lb. A 2 hp., 1,150 r.p.m. motor is used.

Silchrome Stainless Steel Castings

Silchrome stainless and heat-resisting steel castings made from steel prepared in the hollow electrode furnace, announced by Buffalo Foundry Div., Ludlum Steel Co., Buffalo, N. Y., are claimed to be unusually free from porosity and to possess excellent corrosion resistance. These castings can be produced from steels



Sand blasted castings of Silchrome stainless and heat-resisting steels show good surface quality

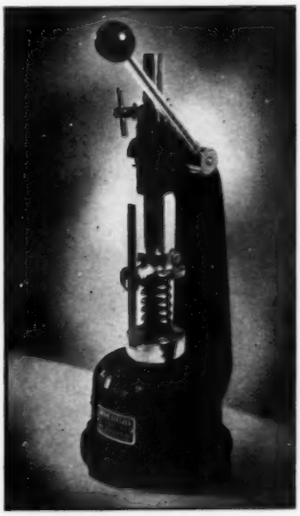
of a wide range of controllable analyses. Stainless steels have been produced with a carbon content as low as 0.03 per cent, but usual carbon analysis for castings is maintained between 0.06 and 0.10 per cent unless otherwise specified. Conventional sand mold practice of the steel foundry is used and the molds are baked or skin dried as necessary. The steels react favorably to heat-treatment, which increase the elongation and reduction of area properties.

Castings have been found to have better machining qualities than are ordinarily encountered in similar products cast from metal melted in usual type electric arc furnaces. In the as-cast condition, castings made from steel melted and refined in the hollow electrode furnace possess good salt spray and atmospheric corrosion resistance. After heat-treatment they show marked resistance to mixed acids.

Link Spring Checker

Available in two capacities, the spring checker offered by the Link Engineering & Mfg. Co., 1054 West Baltimore Ave., Detroit, Mich., is designed for production testing of coil springs and is accurate beyond government requirements. Model No. 1 has a 50-lb. capacity and is calibrated in ¼-lb. units; Model No. 2 has 250-lb. capacity and is calibrated in 1-lb. units. The weighing table is mounted on a centrally located pilot-shat ball bearing, eliminating friction and lateral movement. Overloading is prevented by relieving the weighing unit of further load when maximum capacity has been reached.

In operation the spring is placed on the table and the hand lever is pulled; spring length and strength are read direct on the scale and dial. The action is in a straight line.



Fostoria Model U-58 Uni-Focal Localite

The Model U-58 Uni-Focal lighting unit, offered by The Fostoria Pressed Steel Corp., Fostoria, Ohio, is specially designed for installation on benches and tables that are subject

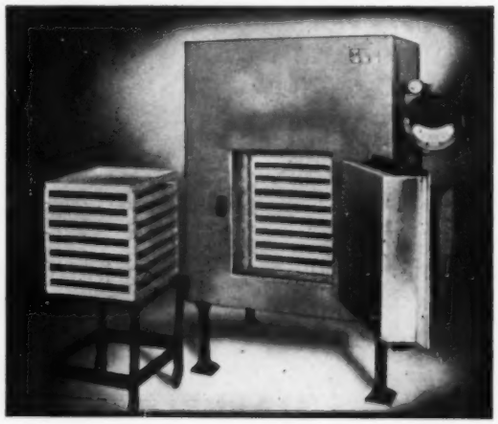
to excessive vibration. Equipped with a ball and socket joint at the reflector and a spring friction joint at the top of the base, this unit is completely flexible, horizontally and vertically without the use of tools, yet it is rigid in any position. The unit has an over-all length of 33 in., and the base is 14 in. high. Horizontal arm is 15 in. long with a reflector assembly mounted on the end. This assembly consists of a Uni-Focal reflector, the supporting rim equipped with porcelain socket and a clear glass lense. Reflector snaps on to the supporting rim for ease in cleaning the unit and replacing bulb. Although designed for a 60-watt bulb, a 50-watt mill-type or a regular 40- or 25-watt bulb may be used with proper extension socket. Light rays from the aluminum reflector are reflected to a converging beam, bringing the light to focus about 18 in. ahead of the reflector.

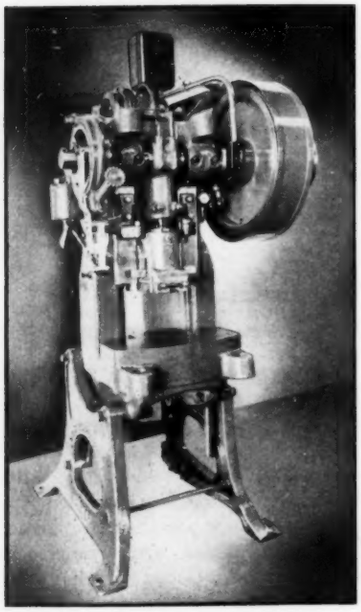
Despatch Cross-Flow Treating Furnace

The Despatch Oven Co., 622 Ninth St. S.E., Minneapolis, Minn., has arranged a Despatch cross-flow, forced-draft furnace for heat-treating *"Duralium"* automatic reel parts. After the various parts are punched and pressed into shape, they are loaded in a special nesting tray arrangement which is then placed in the oven. Heat-treatment is at 925 to 950 F. for a period of 20 min. Uniform heat distribution and rapid heat transfer make possible a high-speed production schedule and assures maximum uniformity of the *"Duralium"* parts.

This furnace is electrically heated with a 7-kw. heating system which is automatically controlled with a Brown mercury-filled indicating control. Insulation consists of 6 in. of Rockwool. Inside working dimensions are 19 in. wide, 18 in. deep and 24 in. high.

The furnace has been mounted on a stand to bring it to proper working level and the nested trays are run into the furnace from a special dolly. The fan and heating system are located on top of the furnace and heated air is forced through a duct down the right side of the furnace to the bottom, then horizontally across the furnace to the left side. It is then returned to the heating system by a duct on the left side for reheating and recirculation.





V & O Inclinable High-Speed Press

The V & O Press Co., Hudson, N. Y., is offering a high-speed press of the inclinable type, having approximately 30 tons capacity and operating at speeds of 300 strokes per minute. The machine is fitted with a multiple-disk friction clutch and a brake which works in conjunction with the treadle. The brake is so arranged that when the treadle is released a cam holds the brake open until a switch disengages the clutch. When the clutch is opened the brake is applied, stopping the press at the top of the stroke. An automatic lubrication system provides lubrication to all the bearings. This press has all of the V & O features, such as a long slide, overhanging bearings and eccentric shaft, as well as a shallow throat and a filled-in bed. Mechanical feeds can be fitted to these machines for high-speed operation.

Disston "Bite-Rite" Hand Files

"Bite-Rite" hand files, manufactured by Henry Disston & Sons, Inc., Tacony, Philadelphia, Pa., feature staggered teeth which cut level and smooth. A round, smooth, open gullet that is non-clogging has been included in the design of these files. Filings gathered in actual tests are long, heavy and curled like chips from a lathe tool. It is claimed that fewer strokes are required with this type file.

Chicago No. 970-G Portable Grinder

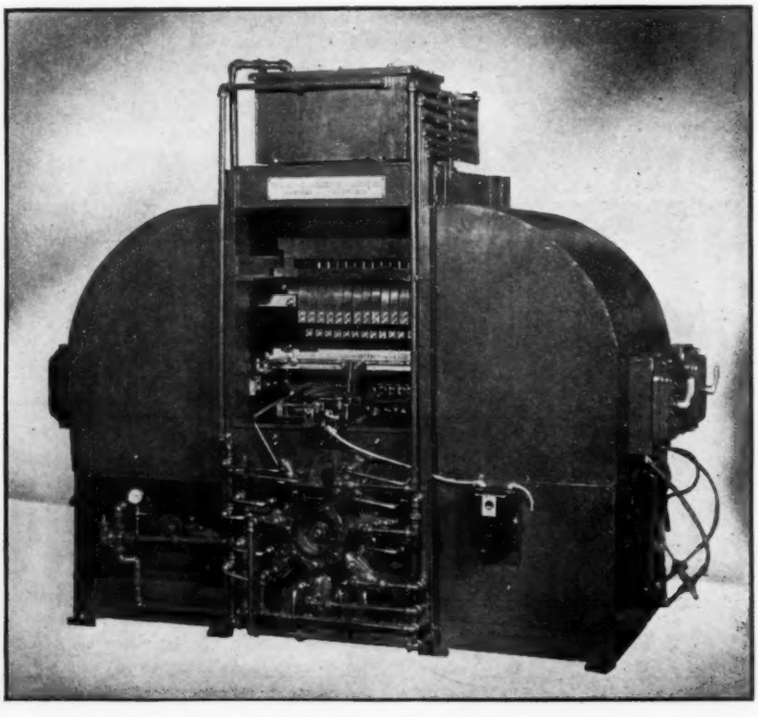
The No. 970-G grinder, offered by the Chicago Pneumatic Tool Company, 6 East 44th St., New York, N. Y., is a production unit for general-purpose grinding. With proper wheel equipment, this electric tool also can be used for wire brushing, buffing and polishing all types of metal surfaces. The totally inclosed, fan-cooled motor has sufficient power

to maintain high speed under load. Specifications: wheel size, 6 x 1 in.; speed, loaded, 2,600 r.p.m.; net weight, 22 lb.; over-all length, 24½ in. The wheel guard is adjustable.

Thomson-Gibb Multi-Spotmatic Resistance Welding Machine

The "Multi-Spotmatic" resistance welding machine shown has four transformers and a series of hydraulic plungers which act in sequence to make a series of spot welds. Manufactured by the Thomson-Gibb Electric Welding Co., 164 Pleasant St., Lynn, Mass., this machine has a special work-carrying table and indexing arrangements so that rows of spot welds can be made at fixed positions across the work.

The rotary control valve located on the front of the machine controls the pressure and duration of current flow for each individual weld and permits variation in the thickness of metals being welded. This valve consists essentially of a fractional-horsepower motor driving through a reduction unit. Keyed to the shaft from the reduction unit are two disks or drums. These disks carry cams which operate the hydraulic valves and relay switches that control pressure and current applied to the weld. Switch cams are adjustable to permit a long or short period of current dwell. Cam shaft may be revolved at speeds ranging from 4 or 5 r.p.m. up to 50 or 60 r.p.m., depending on the type of work being welded. The control valve makes it possible to use transformers of smaller capacity than would be required if all welds were made at one time by projection welding. Arrangement of the welding points can be altered.



Bristol Electric Flow Meters

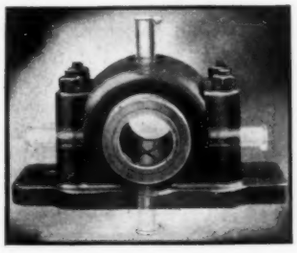
The Bristol Co., Waterbury, Conn., has announced the addition of a complete line of electric flow meters for steam, liquids and gases. These meters operate on the Bristol "Metameter" principle of telemetering, which has been used for several years to transmit readings from the point of measurement to a distant point where they are recorded or indicated on a dial.

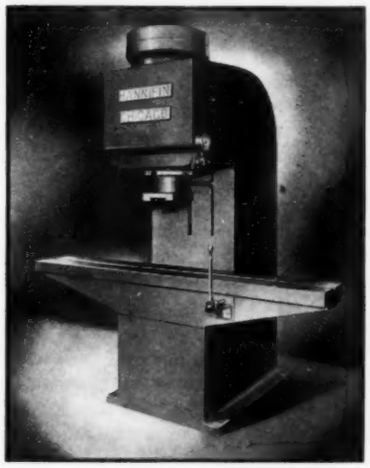
Electric flow meters can be furnished for recording, integrating and indicating flow. Readings are transmitted over a simple two-wire circuit which does not enter into the calibration of the instrument. All electrical contacts are inclosed in glass. High accuracy is obtained at all points on the scale. Both the transmitter and the receiver are equipped with moisture-, fume- and dustproof aluminum alloy cases. Conduit openings are provided.

Randall Universal Pillow Block

This universal, double-reservoir, oil-return pillow block, announced by the Randall Graphite Products Corp., 609–613 West Lake St., Chicago, Ill., can be mounted in any position according to the requirements of the individual installation. It is necessary only to select the mounting position needed, unscrew the oil cup, turn the ball to this position and reinsert the oil cup in a vertical position.

This pillow block, like other D.R.O.R. bearings, has two large reservoirs in the spherical ball. A supply of oil is placed in the upper reservoir which feeds the shaft as needed through graphite feed plugs and graphite pressure-packed channels. Oil recovery grooves divert unconsumed oil into the lower wool-packed reservoir and from there it is again fed to the shaft.





Hannifin 75-Ton Straightening Press

This 75-ton sensitive hydraulic straightening press, offered by the Hannifin Mfg. Co., 621 S. Kolman Ave., Chicago, Ill., has been especially designed for straightening operations on airplane propellers and similar work. A single lever controls the entire operation of the ram with a sensitive proportional control action. When the control lever is moved in either direction the ram will move a proportional distance and then stop.

When in neutral the pump idles at zero pressure. The hydraulic power unit, with constant-delivery rotary pump, is built into the base of the press, making a self-contained unit that requires a minimum of floor space. Ram stroke is 12 in. Speeds are 24 in. per min. power stroke and 40 in. per min. return stroke. Specifications are: distance from table to ram (up), 18 in., center of ram to face of frame, 10 in.; length of table, 84 in.; height of table, 36 in.; overall height, 100 in. Base is 32 x 52 in.

M & W "Chroprime"

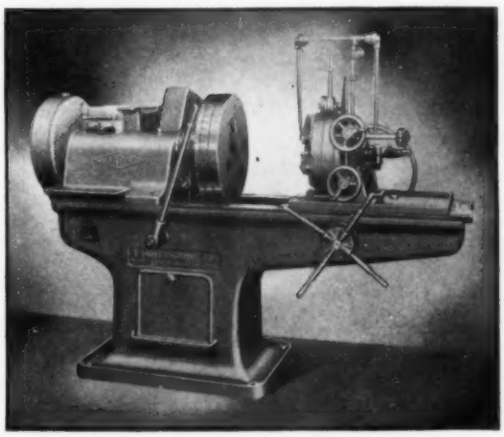
"Chroprime," developed by Maas & Waldstein Co., 420 Lexington Ave., New York, N. Y., is a clear primer which can be applied to a chromium surface by spraying or dipping, after which it is baked. By using this primer, it is claimed that chromium can be finished in any desired color; "Chroprime" will adhere to the metal surface and will provide a good foundation for any kind of lacquer enamel.

"Chroprime" will resist heat and remain flexible. It is at present finding application in the production of automobile name-plates and for other purposes where colors are wanted on a corrosion-proof base. This primer can also be used as an undercoat for finishing other metals.

Landis 2-In. Pipe Threading Machine

The Landis Machine Company, Inc., Waynesboro, Pa., has announced revisions in design of the 2-in. Landis pipe threading and cutting machine. Bed has been made heavier and stronger and the ways are covered by steel guards. Available in both belt- and motor-driven models, these machines are equipped with an eight-speed, built-in gearbox. Speeds of the chuck range from 30 to 163 r.p.m. Headstock is mounted directly on the bed, making for greater rigidity. No changes have been made in the die-head, cross rail, cutting-off attachment and chuck, which remain the same as on the old machine.

This machine has a capacity for threading pipe from ½ to 2 in. diameter inclusive. The carriage travel is 14 in. Floor space required is 3 ft. 7 in. by 6 ft. 8½ in. The motor-driven machine has a net weight of 3,000 lb.

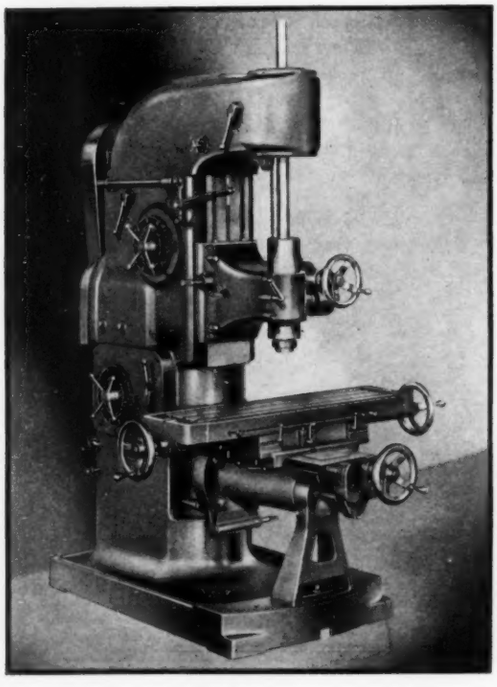


Knight No. 40 Vertical Miller

The No. 40 vertical milling machine, announced by the W. B. Knight Machinery Co., 3920 West Pine Blvd., St. Louis, Mo., has sixteen spindle speeds ranging from 40 to 1,400 r.p.m. There are four spindle feed changes ranging from 0.002 to 0.010 in. Spindle has vertical power feed of 8 in. in either direction. An automatic throwout is built into this feed to prevent the spindle from traveling beyond its limits and a graduated throwout is available to enable the operator to drill or bore in either direction to a predetermined depth.

The sixteen table feeds range from ½ to 12¾ in. per min. and, as in the case of the spindle feeds, these table feeds can be quickly set at the desired point by use of an easily read dial. There is an automatic throwout built into the feed line and this is provided with an overload release. All speed and feed control levers are centrally located.

The main drive shaft is equipped with a brake which can be used to stop the spindle rapidly. The spindle is furnished with a No. 12 B. & S. taper; an adapter is provided to reduce this to a No. 10 taper when desired. Table construction permits tilting the table to either side of horizontal; at the same time it can be swiveled around the column. Provision is made on the table unit for dial indicator equipment.



Specifications: longitudinal power feed of table, 28 in.; transverse power feed of table, 14 in.; maximum distance from table to spindle, including adapter, 21 in.; distance from face of column to center of spindle, 14 in.; spindle head travel on column, 15 in; spindle travel in head, 8½ in. Working surface of table is 12 x 46 in. and the distance from the floor to the top of the table is 33 in. Drive is by V-belt from a 5-hp. motor through a multiple dry-disk clutch. Floor space required is 78 x 93 in. Net weight is 5,900 lb.

Roxalin Synthetic Metal Finishes

The Roxalin Flexible Lacquer Co., Inc., Elizabeth, N. J., has announced improvements in synthetic finishes for metals as a result of the development of new rubber-base raw materials. The improvements apply over a wide range of commercial applications. One of the new products is a non-silking, drierless, roller coating material that is clean and free from nibs of oxidized or polymerized particles. It does not skin in the container or in production, is available in all colors as well as in black and white and has good adhesion on all metals without the use of a size coat. Metal sheets can be put through a wide range of forming operations without damage to the finish.

Another material announced is a base for ground coat material for use under wood grain reproductions, particularly for application to flat metal sheets prior to forming. A short force-dry or a low temperature bake is required, after which the wood graining is applied. There is also a clear top coat or protecting coat which may be applied by roller coating or by dipping or spraying. After baking, a lustrous wood effect finish with good depth may be buffed in the sheet. The sheet can then be blanked and formed into the necessary shapes.

Another development is a synthetic finish with perspiration resistance which sets in air almost as fast as lacquer. It is said to produce a flexible finish with high lustre and to have good adhesion to practically all metals including zinc die castings. It is particularly adapted to high production work with automatic spray equipment.

Walker Portable A.C. Demagnetizer

The O. S. Walker Co., Greendale, Worcester, Mass., is now manufacturing portable demagnetizers suitable for a wide variety of work and particularly adapted for the removal of residual magnetism from machine knives, shear blades and large dies. The laminated core of the unit is mounted in a frame with handles and is recessed for the energizing coil. It is inclosed in a 4½ in. diameter by 5½ in. long cylinder which rotates about the core as the unit is moved along the work. The cylinder heads are mounted on oilless bearings and the cylinder is of a material which exerts a minimum influence on the path taken by the demagnetizing flux.

The unit shown is suitable for work 1 in. or more in thickness and the current is controlled by the pistol grip switch conveniently placed at one of the handles. This arrangement of the switch insures the current being in the energizing coil only while the unit is in use, thereby protecting the coil against overload. For ordinary purposes where the work is usually less than 1 in. thick, a unit having a smaller coil is recommended. The current to the energizing coil of this unit is controlled by a snap switch.

In use, the unit is energized and rolled along the work, this movement being continued in the same plane for a short distance beyond the end of the work to make sure that the work is no longer in the magnetic field. Frequently one pass over the work is sufficient, but in some cases a second pass may be found necessary. Standard units weigh approximately 10 lb. and are available for 60 cycle, 110 volts and 220 volts single phase a.c.

American Machinist
REFERENCE BOOK SHEET ©

Oxy-Acetylene Welding Techniques

With gas welding, as with other processes, the necessity to reduce operating costs and to increase the rate has led to rapid development of several distinct techniques. As a result the beginner and experienced welder alike find it difficult to appreciate the economical value and practical applications of these processes. The choice depends upon four principal factors:

(a) The thickness of the material

(b) The kind of material

(c) The position in which the welding seam can, or must, be made; that is, vertical or horizontal.

(d) The accessibility of the sides of the seams; that is, can welding be carried out on one side only, or are both sides of the seam accessible?

For (a) and (b) the leftward, or forward, technique is most suitable for thin sheet steel and both thin and thick non-ferrous metal welding. For steel where the thickness exceeds $\frac{3}{16}$ in., what is known as the "rightward" or "backward" process is more economical and efficient.

With reference to (c) both leftward and rightward welding are essentially underhand techniques; that is, the top surface of the seam, or completed weld, must be within a few degrees of horizontal. If the plane of the welded seam can be adjusted to suit the requirements of the welder or the technique, vertical welding offers some advantages for certain thicknesses of material.

The fourth point (d) is concerned with circumstances under which it may be possible partially to complete the weld from one side as a first operation, and then turn the job over and complete the weld from the reverse side. On the other hand, quite often both sides of the seam are accessible. If this is so, it has been found that two welders, working simultaneously on opposite sides of the seam, can use very small blowpipes, and the edges of the abutting plate need not be beveled, thus reducing gas consumption and the cost of preparation.

Leftward Welding

As the title implies, the operator starts welding at the right hand end of the seam and proceeds in a leftward direction. The blowpipe is held in the right hand and the filler rod in the left. The angles of the blowpipe and filler rod are given approximately in Fig. 1.

For many years it was customary to prepare plate edges above $\frac{1}{8}$ in. thick, so that the contained angle of the V was 90 deg. and a comparatively large quantity of filling material was required, resulting in a slow rate of welding. A swinging, or semi-rotary, movement of the blowpipe is necessary, in order fully to preheat the sides of the V and maintain both them and the filler rod at the required degree of fluidity. When welding steel, this blowpipe movement spreads unnecessary heat over the surface of the material adjacent to the weld. These factors render the process uneconomical for welding steel over $\frac{3}{16}$ in. thick, but it is suitable for cast iron and most non-ferrous metals in any thickness when the weld is underhand.

Rightward Welding

With this technique, while the blowpipe and filler rod are held more or less as for leftward welding, the direction of making the seam is reversed. The angles of blowpipe and rod are shown in Fig. 2. Compared with leftward welding the efficiency and economy of the process are considerably improved. The V can be smaller, and it has been found that a 60-deg. included angle is the most practical and econom-

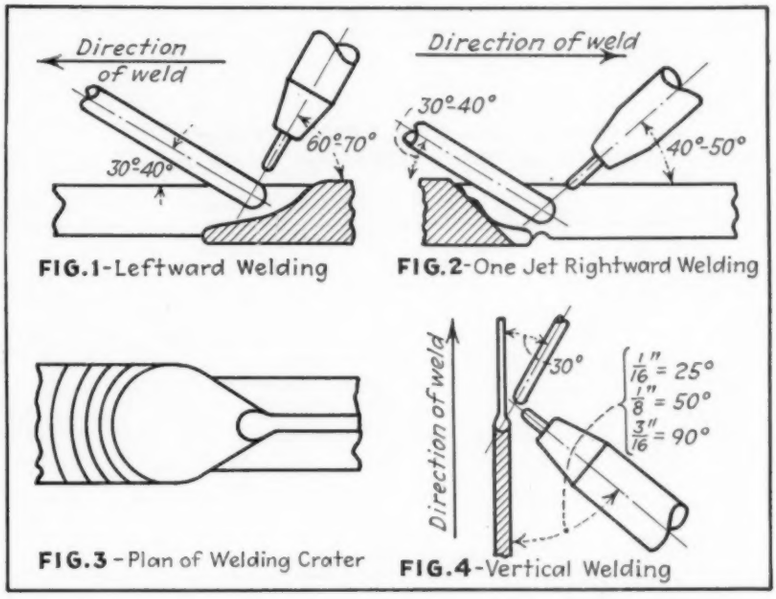


FIG. 1-Leftward Welding

FIG. 2-One Jet Rightward Welding

FIG. 3-Plan of Welding Crater

FIG. 4-Vertical Welding

Approximate Amount of Welding Rod Required

V	Plate thickness	Distance between bottom edges of V	Length of welding rod (in feet) for various diameters (inches)* Per foot of Weld						
			1/16	1/8	3/32	1/16	5/32	1/4	5/16
80°	3/32	1/32		4.8	3.1				
	1/4	1/32		8.4	5.4	3.75	2.75		
	5/16	1/32			7.5	5.2	3.85		
	3/8	1/16				7.6	5.6	4.25	
	1/2	1/8					9.5	7.25	5.0
60°	3/32	1/32		2.5	1.7	1.2			
	1/4	1/32		5.5	3.5	2.4	1.8	1.35	
	5/16	1/16			5.5	3.75	2.75	2.1	
	3/8	1/16				5.2	3.8	2.9	
	1/2	1/8					6.2	4.75	3.0
	5/8	1/8						6.75	4.3
	3/4	1/8						9.7	6.2
	1	1/8						12.7	8.3
	1 3/8	1/8						16.5	10.5
No V	1/4	1/32	3.75	.95	.6				
	5/16	1/32	8.5	2.1	1.3	.9			
	3/8	1/8	14.5	3.7	2.4	1.6			
	1/2	1/32		5.8	3.7	2.6			
	5/8	1/16			5.4	3.7			
	3/4	1/16				5.5	4	3	
	1/2	1/4							

* In the case of V welds the rod lengths include an allowance for reinforcement or build up on the surface of the weld and under side penetration. The no- V rod lengths include an allowance for bead on both sides of weld.

Oxy-Acetylene Welding Techniques

ical. The blowpipe has only one movement; that is, along the seam, while the welding rod has a very slight rotary movement. The blowpipe flame has direct access to the sides of the V; no unnecessary heat is spread over the surface of the plates. There is no tendency to force molten metal along unprepared sides of the V. Increased welding speed is achieved by slightly increasing the power of the blowpipe, and by the reduction in time required to deposit the smaller quantity of filler rod necessitated by the smaller V.

The operator is able to insure thorough penetration of the weld metal, as he is able to observe the actual melting of the bottom edges of the V. When these melt, the slot at the bottom of the V enlarges into a round hole, Fig. 3, immediately in front of the welding face. As long as the welder maintains this hole, it is obvious that the bottom edges of the V are melting, and that the weld metal is penetrating to the underside of the seam.

On steel up to $\frac{3}{8}$ in. thick, welding is completed in one run, but, above this, "step" welding is used. At the beginning of the weld, 4 or 5 in. of the bottom of the V are welded. The weld is then restarted at the beginning of the first run, and the full depth of the V completed, this run being carried along over the first run and beyond it for 4 or 5 in. at the bottom of the V. The next run, or step, is then started where the second run tapers down from the top of the V.

The welding of unbeveled edges has been carried out effectively to $\frac{3}{8}$ in. and more, but it is considered that the method is limited to $\frac{5}{16}$ in. steel plate as a maximum.

Speeds and Gas Consumption for Welding With Different Techniques

RIGHTWARD OR BACKWARD WELDING

Plate thickness	Approx. b'pipe power c. ft. of acety. per hr.	Approximate rate of welding: Ft./hr.	Approximate rate of welding: Mins./ft.	Welding wire: Size, ins.	Welding wire: Approx. consm. ft./foot of weld	Preparation of welding edges
$\frac{1}{16}$	22—26	15—16	3½— 4	$\frac{1}{16}$	2½	
$\frac{1}{8}$	30—35	10—11	5½— 6	$\frac{1}{8}$ or $\frac{5}{32}$	5½ or 3½	No V
$\frac{3}{16}$	35—40	7.5— 8	7½— 8	$\frac{5}{32}$ or $\frac{3}{16}$	5½ or 3¾	
$\frac{1}{4}$	40—45	6— 7	8½—10	$\frac{3}{16}$ or $\frac{7}{32}$	5¼ or 3¾	Single 60° V
$\frac{5}{16}$	52—56	4.5— 5	12—13½	$\frac{1}{4}$	4¾	
$\frac{3}{8}$	65—70	4—4.5	13—15	$\frac{1}{4}$	7	
$\frac{7}{16}$	75—80	3—3.5	17—20	$\frac{1}{4}$	10	Double V or
1"	95—100	2—2½	24—30	$\frac{5}{16}$	7¾	

LEFTWARD OR FORWARD WELDING

$\frac{1}{16}$	3— 4	20—25	2½—3	$\frac{1}{16}$	1	
$\frac{1}{8}$	5— 6	24—28	2¼—2½	$\frac{1}{16}$	1¾	
$\frac{3}{16}$	7— 9	20—25	2½—3	$\frac{1}{16}$	2¼	No V
$\frac{1}{4}$	10—12	18—20	3 —3½	$\frac{1}{16}$	2¼	
$\frac{5}{16}$	15—20	12—15	4 —5	$\frac{1}{8}$	2¾	*Single 80°
$\frac{1}{4}$	20—25	8— 9	6¾—7½	$\frac{1}{16}$	2¾	V

UPWARD VERTICAL WELDING — ONE WELDER

$\frac{1}{16}$	2.5—3	15	4	$\frac{1}{16}$	30	$\frac{1}{16}$	No V for steel.
$\frac{1}{8}$	3½	12	5	$\frac{1}{16}$	33	$\frac{1}{16}$	Single 90°.
$\frac{3}{16}$	5½	10	6	$\frac{1}{16}$	38	$\frac{1}{32}$	V for non-
$\frac{1}{4}$	8	7	8½	$\frac{1}{32}$	46	$\frac{1}{8}$	ferrous metals. $\frac{1}{8}$" upwards.

UPWARD VERTICAL WELDING — TWO WELDERS

$\frac{1}{4}$	10	10—11	5½—6	$\frac{1}{8}$	2¾	For steel no V, distance between edges = $\frac{1}{4}$ to $\frac{1}{3}$ T. For non-ferrous metals 90° double V over $\frac{3}{4}$".
$\frac{3}{16}$	16	7—8	7½—8½	$\frac{1}{32}$	4	
$\frac{1}{2}$	25	6—6.5	9—10	$\frac{1}{32}$	7¼	
$\frac{5}{8}$	3.5	5.5—6	10—11	$\frac{1}{16}$	6¼	

Generally for aluminum use a blowpipe one size smaller than for steel, and for copper a blowpipe one size larger than for steel.

* For cast iron and non-ferrous metals bevel to 90°. Leftward welding can be employed for cast iron, copper and aluminum over ¼" thick; blowpipe sizes *pro rata* to those given. Generally, for aluminum use a blowpipe one size smaller than for steel, and for copper a blowpipe one size larger than for steel.

Vertical Welding

For welding sheet steel containers and similar articles where it is essential that the underside of the weld be as good as the top side, which is visible to the operator, vertical welding can be employed up to $\frac{3}{16}$ in. thickness. The edges of the plate are left square and brought together, leaving a small space between them. Welding is carried out in an upward direction. The welder fuses both edges of the plate and produces a round hole, similar to that described for rightward welding. Welding rod is applied at the same time, and the molten metal flows away from the blowpipe flame and bridges the gap between the edges of the two plates beneath the flame. The angles of the blowpipe and rod and the hole effect between the two plate edges are indicated in Fig. 4.

This technique is generally limited to steel; the same technique has also been successfully applied to stainless steel with the weld surface in the horizontal plane. Some operators have been successful in welding copper and aluminum by this method, but it is limited to plates $\frac{3}{32}$-$\frac{1}{16}$ in. thick and cannot be used for very thin plates.

The chief advantages of vertical welding are the eliminating of beveling of the plate edges, only a small amount of welding rod is needed and the blowpipes employed are less than half the size of those employed for rightward welding. The two-welder method is suitable for steel and non ferrous metals upward of $\frac{1}{16}$ in. thick. Although with the two-operator method the labor cost is doubled, it has been found in practice that this is off-set by the high speeds and the reduced amount of gases and welding rod consumed.

Another important point with vertical welding is that the distortion across the weld is reduced to a minimum, as the weld between the two plate edges is approximately uniform throughout.

For the copper and aluminum, especially, the two-operator vertical method is essential for the production of homogeneous welds having an equal bead on each side of the weld. It is not possible to omit the beveling of the plate edges to the same extent as for steel; single-operator welding necessitates a single 90 deg. V over $\frac{1}{8}$ in. thick, and two-operator welding necessitates a double 90 deg. V over $\frac{1}{16}$ or $\frac{1}{4}$ in thick.

Abstracted from "The Welding and Cutting Yearbook—1936/37," published in London by The Temsbank Publishing Co., Ltd.

Round Table

Tool Tickets

"What's this new fancy rack I see in the toolroom, Al? Gone highbrow again?"

"Just a rack for holding slips that will help us keep better track of tools, I hope, Ed."

"What's the matter with the old brass check, Al? We get along with that in our plant, and it's a lot bigger than this."

"You could probably get along without any. I know shops that do. But I'm hoping this will save us real money in several ways."

"Must have cost a lot to put it in. A lot more than brass checks. Just what is it all about?"

"Well, Ed, I've been thinking for some time that we were spending too much for tools for a shop of this size. Some of our gages and reamers run into real money, and they seem to need too many repairs."

"Don't your tool man look after that, Al? He ought to keep track of damage to tools."

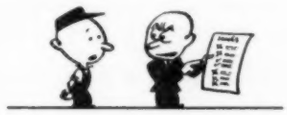
"Easier said than done, Ed, with the brass check."

"What difference does the check make? If the tool is damaged it's the same man and the same tool."

"True enough, Ed. But the paper slip gives us a record of who uses the tools. We have the name of the tool and the man's name on the same slip. Then there's no denying who is responsible. And by just filing these slips together for any given tool we can see what it costs to keep that tool up. If it's too costly we can try another make."

"Seems to me there is more point in keeping track of the men than of the tools, Al. Tools don't break themselves."

"Some do, Ed. Or at least they break more easily than others. But



we can also check up on the breakage of each man over as long a period as we like."

"It still seems complicated to me. I don't like paper-work in the shop."

"Neither do I. But there are worse things than paper work—if you don't overdo it. Before I decided to make the plunge, I talked with several men who have shops similar to this. One shop saved the whole cost the first year. The records showed they had many duplicate tools that were seldom used. They showed which tools needed most repairs and which men had the most breakages."

"Al, I know shops that have tried this scheme and then gone back to the brass check. First thing I know you'll be keeping tabs on how often I come down here to look the place over."

"I may at that, Ed, and make you sign your name to all the complaints you make. I'm also thinking of keeping track of how many repairs the different machines in the shop need to keep them running. It may give me a good excuse to buy some new ones."

Do tool tickets make it easier to keep track of tools and men? Or is the brass check good enough?

Discussion

Not Naturalized

Surely in these days when there are thousands of American-born and naturalized citizens looking for work, no public-spirited American business man would hire an alien, as Ed suggests. Until business gets back to normal, all concerns should hire American citizens only.

Any alien who has been earning his living in this country long enough to be naturalized, and who does not think enough of this country to take out his papers of allegiance, should not be allowed to hold a job that the average citizen can fill. It does not seem fair to find so many foreigners working while so many citizens are tramping around looking for jobs, and in many cases being told that men of certain nationalities only are being hired. It makes loyal American citizens wonder if they would be better off if they were foreigners.

It is ridiculous to say that foreigners have skill superior to that of American workmen. There are no workmen in the world who take more pride in turning out first-class jobs than American citizens.

Not so long ago the slogan "Buy American First" was in evidence everywhere, then it disappeared. Why

not change the slogan to "Hire Americans First," and see what results it would bring?

—HUGH M. MITCHELL.

Good As New?

There can be no one answer to the question as to whether it does or does not pay to repair a machine. I have helped overhaul several locomotives in my time whose cost of overhauling was greater than the price of a new locomotive. Yet railroads did and do just that. In their particular cases the overhaul work provides take-up employment for the men at odd hours, is a training ground for apprentices, and the cost is spread over a period of time and not noticed as it would be if an appropriation were asked for to buy a new engine.

A turret lathe is a poor subject to discuss. Bearings may be replaced, a new lead-screw and feed rod added, the spindle put back in shape, but I never knew just what to do with the worn places on the ways. The ways always are worn, particularly near the headstock where the cut-off work is done, and so I admit a fondness for scrapping lathes when they reach the overhaul point. But I love to hang on to decrepit pumps.

—J. K. MATTER.

Not so very long ago most engineers in England would have been in entire agreement with Ed that new machines were the only way of improving machine shop equipment. Within the last six months all this has been altered. Delivery of machine tools from the makers are now being quoted as far ahead as eighteen months, and the hard pressed production engineer is now only too glad to buy reconditioned machines and to overhaul and rebuild many machines that would otherwise have been thrown out as obsolete.

R. G. HEWITT,
Huddersfield, England.

There are rival fans in engineering as in most everything else. Some with a flair for the new are always swapping horses, even in midstream, in order to have the last word in design. Others, equally assertive, seem almost temperamentally unable to see the need for a change no matter how obvious it may be.

In the question of new *vs.* old, it should be remembered that facts and data are generally available and performance values can at least be approximately checked. Initial costs have to be evaluated against service earnings. The value of a machine may be roughly assessed in inverse ratio to its maintenance cost. If a machine requires constant repairs, it might easily be, instead of a decreasing asset, an increasing liability. However, many a well cared for, well treated old timer continues to turn out good work at a reasonable cost, and a changeover to a new machine to be justified requires that superlative results shall be obtainable.

—W. ROLAND NEEDHAM,
Stafford, England.

Sometimes it pays to recondition old and trusted machine tools. Al cites the case of a turret lathe that is suited for the work it has to do, and which can do that work just as economically as can a new machine having hosts of gadgets, all of which are not used on many jobs and would hardly be missed if they were not there.

Whether or not a rebuilt machine is as good as new is quite a different matter. Al makes no such claim. Just how good a rebuilt machine is depends entirely upon the care that is put into the work. The man doing the work must know when to scrap a part and when to recondition it. Also he must have a nice idea of the difference between real and false economy, an understanding of which, after all, is the answer to the whole argument.

—E. N. FARRAR,
Ipswich, Suffolk, England.

To the Lowest Bidder?

The answer to this question has been a problem to all purchasing agents and plant executives. To the larger purchasers, such as the U. S. Government, state governments and municipalities, the pitfalls of accepting the lowest bids are drastically minimized. They know what they want and express the details of their requirements in comprehensive specifications. They further protect their interests by requiring an adequate bid bond with each proposal. Award to the successful bidder is generally contingent upon his furnishing a performance bond, which eliminates all but those who are actually qualified and will deliver according to specifications. So that the interpretation of specifications will not be left entirely to the bidder, rigid inspection is to be provided.

If all concerns are not in position to set up machinery for their own protection, then the only safe method for them to follow is to know definitely what they want and to use such means as they may have to insure that it is obtained. It is dangerous to accept a bid on anything without investigating the bidder's ability to make delivery in strict accordance with the best American practice. Even without the protection of specifications, there are occasions when it is permissible to accept the lowest bid. The decision may be reached on the knowledge that the quotation is based on the bidder having superior equipment.

—HAROLD L. WYNN,
Executive Engineer,
Pacific Electric Mfg. Corporation.

Since it is a certainty that Buckley will force himself out of business and that the longer he stays in business the more harm he is doing industry, the question might be asked: "How can we help Buckley drive himself out of business as rapidly as possible?"

Any answer to this question is decidedly anti-social, but regardless of whether Al or Ed's theory is adopted, they are both contributing to Buckley's downfall. Al attempts this by ignoring him, and Ed would accomplish the same end by placing an order for an article, which he knows is being sold for less than it cost.

Of the two, I believe that Ed's plan is more beneficial to society and the one which is based on sounder economics. It is more beneficial to society because it is less anti-social to Buckley. It is a sounder economical program because it is keeping open a supply for inexpensive equipment a longer period than it could survive if it received no patronage at all.

Al's supposition of Buckley putting Sanson out of business is probably not founded upon fact. I do not believe that companies which do not know how to make money, rarely, if ever, permanently dispossess those that do. —HAROLD HOFFMAN,
Pioneer Instrument Company, Inc.

One Foreman

If Jim Taylor is allowed to appoint or nominate his assistant all will be well, but a great deal of trouble may arise if Al exercises his authority and independently makes the appointment. To have two entirely independent foremen in charge of one department is a sure source of trouble and worry to the superintendent.

—F. P. TERRY,
Belfast, Ireland.

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Editorials

Judges or Courtiers?

SUPPOSE that an Old Deal Congress, at the behest of an Economic Royalist President, had passed laws forbidding men to organize into labor unions, and giving a few huge corporations monopolistic control of American business. And suppose further that an independent Supreme Court had thrown out these laws as unconstitutional. How eager would the present administration members and their legislative satellites be to cripple the power of that court to protect the public interest?

Does this sound absurd? Remember that the pendulum of public opinion, and votes, in this country has swung from radicalism to conservatism in the past more than once, and is likely to do so again. A court impotent to invalidate an NIRA would be equally unable to keep a Tory government from enacting laws like those mentioned above.

In a recent broadcast Senator Minton included among his "checks" that would prevent a President from becoming a dictator, once he could control the Supreme Court, "the honor and integrity of President Roosevelt, in whom you and I have confidence." If by honor and integrity Senator Minton means statesmanship and wise leadership, then some seventeen million voters expressed considerable lack of confidence last fall, and many more are doubtful now.

Mr. Roosevelt's proposal to add a judge to the bench for every one who passes the age of seventy and does not retire would be regarded as silly if it were not so sinister. It is tantamount to an admission that there would be too much public oposition to the emasculation of the Supreme Court to allow it to be done by the established legal processes.

A WASHINGTON commentator represents the President as willing to consider a better plan than his if some member of Congress can suggest one. That should not be hard to do if Congress is convinced that the voters want the Court eliminated as a check on ill-considered legislation.

The proposal of Representative Smith of Washington that an advisory referendum be taken to determine the attitude of the voters toward the scheme to reduce Supreme Court justices to the rank of courtiers, if we may be forgiven that much levity, sounds sensible. Unless, of course, there is the same reason against it that moved John L. Lewis to fight against a referendum in the General Motors strike. In any event here is one time when all of us can well afford to add to the load of Washington mail to say where we stand on the Supreme Court.

Strike Statements

AS THE futile sit-down strike in Flint automobile plants finally ended three men made statements. Here they are.

JOHN L. LEWIS—"Another milestone on labor's march. The agreement established collective bargaining and security for the union . . . The automobile workers can rejoice in their achievement. The precision and efficiency of their strike has been magnificent. Their devotion and self sacrifice has been rewarded. They can now perfect their union and go forward."

WILLIAM GREEN—"Reports indicate that the original demands of the U.A.W. for exclusive collective bargaining for all General Motors employees were abandoned. The whole of labor is injured when one division of labor's army sustains defeat."

WILLIAM S. KNUDSEN—"There is no crowing on either side—I hope not. What we think is most important is to get people back to work, and get the plants running again. You know, when a big machine is stopped, you have to monkey with the fly wheel a bit before you can get it going again . . . There must be a desire for peace and no animosity on either side."

One man came out of this unfortunate muddle with greatly increased stature. It is not hard to pick out which one.

CHIPS

WASHINGTON

Roosevelt includes in his message detailing improvements in United States courts a plan to pack Supreme Court which arouses vigorous resentment and condemnation from all parts of the country . . . Senators Ashurst and Robinson force debate of the issue in the upper house, Ashurst, Judiciary Committee chairman, again showing inconsistency and declaring the bill the "mildest" possible and marveling at the "moderation" of the President . . . House votes measure providing full pay for retiring justices of the Supreme Court . . . Senator Walsh threatens repeal of Walsh-Healy Act unless Labor Department modifies its administrative severity, has indicated that the act provides means of settling the present impasse whereby the Navy can't get steel . . . Roosevelt is annoyed with steel companies, expresses agreement with the labor provisions of the act, and indicates steps will be taken to break the deadlock . . . Lewis W. Douglas supports Hull's trade treaty policy in Senate committee testimony.

FOREIGN

German newspapers demand return of all Germany's former colonies, claim Italian support . . . Runciman reports that he was unsuccessful in arranging U.S.-British trade agreement . . . Rebellious Catholics force their way into Mexican churches, hold services unmolested . . . Japan's new government makes peaceful overtures to China and the Soviets . . . Free church election ordered by Hitler . . . Spanish Rebels with Italian and German support make important gains . . . Great Britain announces rearmament program involving $7,500,000,000 to be spent in five years . . . Chinese Government indicates peace with Reds and firm stand against Japan.

FINANCE

Chrysler reports record earnings of $14.25 a share and votes $1.50 dividend . . . European funds resume strong flow to U. S. stock market, but Sir Charles Morgan-Webb, British economist, declared that this country has nothing to worry about from such "hot money" . . . Eccles asks continuation of control over money supply for Federal Reserve Board.

INDUSTRY

General Motors strike ends after 44 days with the expected compromise and men go back to work . . . Governor Murphy is given credit for his efforts as mediator and his success in avoiding bloodshed . . . Sloan announces wage increase of five cents an hour, and Packard follows suit . . . Chrysler anticipates them with plant reopened as strike is settled . . . Case plant in Racine opens a ten-cent raise . . . Kelvinator after three months of idleness as workers accept company's terms . . . Management and workers' representatives in Carnegie-Illinois Pittsburgh district council agree on increase of 80 cents a day and a $5-a-day minimum . . . Canadian National Railways air-conditioning coaches and building 125 refrigerator cars at Transcona shops . . . Garment industry C.I.O. unions win 12 per cent increase, will spend $500,000 to organize other industries . . . United Mine Workers prepare to oust William Green . . . P.R.R. lets contracts for Philadelphia-Harrisburg electrification . . . Governor Hoffman warns C.I.O. that sit-down strikes are illegal in New Jersey and will not be tolerated . . . Steel Workers Organization Committee of C.I.O. disregards the Governor's warning, moves to recruit Trenton plants of Roebling's, Crescent Wire and American Steel & Wire . . . Federal Circuit Court denies NLRB demand to upset Bethlehem Shipbuilding works council . . . Sit-down strikes spring up like mushrooms in Detroit bakeries, cigar factories, stamping plants . . . Waukegan police battle Fansteel strikers, who make tear gas ineffective.

INDICATORS

Steel production reaches new high as floods pass and automobile strike ends . . . Electric power output unchanged . . . Business Week's index at 80.2 as against 80.4 a week earlier.

Westinghouse To Hold Machine Tool Forum

The Westinghouse Electric & Mfg. Co. will sponsor a second machine tool electrification forum at their East Pittsburgh Works, April 19-22. The forum will discuss "New Methods and Designs for Machine Tool Electrification."

Papers on the subject of special and difficult problems will be presented by representatives of machine tool builders as a feature of the forum. Talks will also be given by Westinghouse works, application and design engineers. Inspection trips will be included in the program.

Machine Tool Orders Reflect Sustained Demand

After the record index of 257.7 established in December, it is natural to find that the National Machine Tool Builders' Association reports an index of 200.3 for January. This level of business is much better than the average prevailing during 1936, and indicates that the industry has probably moved into new high ground. If so, it means that the fourth consecutive stepup in demand is being experienced since 1933.

More than a third of the companies are now reporting business twice as great as in 1926, as shown in the table "Distribution of Orders." Practically another third is at the 100-200 per cent level, and only 20 per cent of the group reports business less than 60 per cent of the 1926 base.

As a whole, domestic orders are much better than prevailed during the previous year. The index now stands at 156.1 and the major part of the step-down from the December combined index of 257.7 occurred in this category. Foreign orders are off in lesser degree, the index dropping from 52 in December to 44 in January. Moreover, the relative importance of foreign orders to total business done has not changed much, the proportion being 22 per cent.

Porcelain Enamel Institute To Hold Three-Day Forum

F. E. Hodek, Jr., of the General Porcelain Enameling & Mfg. Co., chairman of the Forum Committee of the Porcelain Enamel Institute, has announced that the Porcelain Enamel Institute Forum will be conducted at the University of Illinois, Urbana, May 5, 6 and 7. Mr. Hodek further reported that a program of vital interest to everyone in the industry was developed at a recent meeting of the committee and that speakers and discussion leaders have been assigned subjects for discussion at the 1937 Forum. It is planned to cover enameling problems in hollowware, cast iron and sheet iron enameling shops in the three-day session. The dinner will be on May 6.

Index of Machine Tool Orders

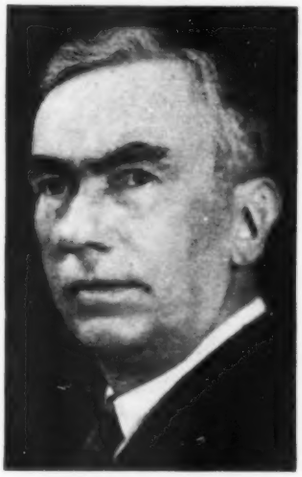
Based on Volume of Shipments for 1936

Month	Index of Orders: Domestic	Foreign	Total	3 Months' Average Index	% Foreign to Total Orders
1936 — January	95.7	15.1	110.8	102.6	14
February	99.8	12.3	112.1	107.1	11
March	89.0	16.3	105.3	109.4	15
April	110.9	14.8	125.7	114.4	12
May	95.7	23.2	118.9	116.6	19
June	106.5	22.3	128.8	124.4	17
July	104.4	45.7	150.1	132.6	30
August	96.1	31.4	127.5	135.5	24
September	82.9	35.6	118.5	132.0	30
October	105.4	31.1	136.5	127.5	23
November	110.7	36.4	147.1	134.0	25
December	205.7	52.0	257.7	180.4	20
1937 — January	156.1	44.0	200.3	201.7	22

Distribution of Orders

Average Indexes of Individual Companies Based on 1926 Level of Business	Companies in Per Cent of Total Number Reporting: 1936 1st Quar.	1936 2nd Quar.	1936 3rd Quar.	1936 4th Quar.	1937 Jan.
200-up	13.0	17.2	15.8	28.4	31.5
100-199	24.6	32.6	28.8	30.2	30.6
60- 99	22.4	19.0	22.9	19.5	14.2
20- 59	26.5	21.8	21.7	15.2	13.4
Less than 20%	13.5	9.7	10.8	6.7	6.7

Medalist at June Convention



DR. FRANK CONRAD

Dr. Frank Conrad Awarded Lamme Medal by A.I.E.E.

The 1936 Lamme Medal of the American Institute of Electrical Engineers has been awarded to Dr. Frank Conrad, assistant chief engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., "for his pioneering and basic developments in the fields of electric metering and protective systems." The medal and certificate will be presented to him at the annual Summer Convention of the Institute, which is to be held in Milwaukee, Wisconsin, June 21-25, 1937.

The Lamme Medal was founded as a result of a bequest of the late Benjamin G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, who died on July 8, 1924, to provide for the award by the Institute of a gold medal (together with a bronze replica thereof) annually to a member of the American Institute of Electrical Engineers, "who has shown meritorious achievement in the development of electrical apparatus or machinery."

Car Plant Expands

Union Metal Products Co., Columbia St. & Gostlin Ave., Hammond, Ind., has let a contract to the Austin Co., Cleveland, for a 2-aisle, 170x1,000 ft. steel building. This will double the company's existing facilities for pressing and fabricating railway car ends. Most of the equipment has been ordered. It includes five Shaw 15-ton electric cranes, a 2,000-ton and a 1,000-ton Bethlehem hydraulic press, and a number of shears and punches.

When Foresight Paid—In 1900 William Lodge put the plant of the Lodge & Shipley Machine Tool Company, Cincinnati, on a knoll, thereby saving the expense and trouble of being flooded out. Here is the flood scene this year with the plant in the center of a lake but still safe by a good 20 ft.

Hot Dip Galvanizers Elect New Officers for 1937

At the annual meeting of the American Hot Dip Galvanizers Association on February 11, in the Hotel Commodore, New York, the following officers were elected: president, T. M. Gregory, of the Hanlon-Gregory Galvanizing Co., Pittsburgh, Pa.; first vice-president, J. M. Hermann, Acme Galvanizing, Inc., Milwaukee, Wis.; second vice-president, Miss D. R. Pearlman, Enterprise Galvanizing Co., Philadelphia, Pa.; secretary-treasurer, Stuart J. Swensson, 903 American Bank Bldg., Pittsburgh, Pa. The new directors are T. M. Gregory, I. M. Hermann, Miss D. R. Pearlman, F. P. Auxer, National Telephone Supply Co., A. J. Blaeser, Joslyn Mfg. & Supply Co., S. J. Gregory, Thos. Gregory Galvanizing Works, and P. Ingersoll, Wilcox, Crittenden & Company.

Modernization Program at H & B American Machine

An extensive program has been inaugurated by the H & B American Machine Co., Pawtucket, R. I., to revamp their shop and foundry, installing modern equipment, tools and methods. Old molding machines are being replaced with the latest types and patterns are being changed to adapt them to these machines. New metal working equipment has been installed in the shop and many of the machines have been relocated.

The present lineup of the organization includes: E. L. Martin, vice-president and general manager; J. W. Richardson, treasurer; Harry Atherton, secretary; William McL. Fraser, assistant general manager; Joseph Chatterton, chief engineer; Christopher Walsh, superintendent; and E. J. McVey, assistant to the vice-president. Otto A. Belger, formerly with the Belger Co., Watertown, Mass., has joined the staff in connection with sales, service and research. Harold E. Fuller has recently been added to the staff to take charge of personnel work. He was formerly associated with Bird & Son, Inc. Three engineers and four mill men have also been added to the engineering and research division staff.

W. H. Harrison Nominated for A. I. E. E. President

The National Nominating Committee of the American Institute of Electrical Engineers has announced the following slate of candidates for offices becoming vacant August 1: For president, W. H. Harrison, assistant vice-president, department of operation and engineering, American Telephone and Telegraph Co., New York; for vice-presidents: (Middle Eastern District), I. Melville Stein, director of research, Leeds & Northrup Co., Philadelphia; (Southern District) Edwin D. Wood, general superintendent, Louisville Gas & Electric Co.; (North Central District) L. N. McClellan, chief electrical engineer, U. S. Bureau of Reclamation, Denver; (Pacific District) J. P. Jollyman, hydroelectric and transmission engineer, Pacific Gas & Electric Co., San Francisco; (Canada District) M. J. McHenry, manager, Toronto District, Canadian General Electric Co., Ltd., Toronto; for national treasurer, W. I. Slichter, Columbia University.

A.F.A. Committee Nominates H. Bornstein for President

Hyman Bornstein, chief chemist and metallurgist, Deere & Co., Moline, Ill., was nominated for president of the American Foundrymen's Association at the meeting of the Nominating Committee held in Cleveland on Feb. 1. The Committee's selection for the office of vice-president was Marshall Post, vice-president and works manager, Birdsboro Foundry & Machine Co., Birdsboro, Pa. The slate selected by the Nominating Committee will be presented at the association's convention and exhibition to be held in Milwaukee, May 3-7.

The Committee's selection for directors to serve terms of three years each were Duncan P. Forbes, president, Gunite Foundries Corp., Rockford, Ill., H. B. Hanley, foundry superintendent, American Laundry Machinery Co., Rochester, N. Y., C. J. P. Hoehn, president, Enterprise Foundry Co., San Francisco, Calif., Thomas Kaveny, president, Herman Pneumatic Machine Co., Pittsburgh, Pa., C. E. Sims, supervising metallurgist, Battelle Memorial Institute, Columbus, Ohio, and James L. Wick, Jr., president, Falcon Bronze Co., Youngstown, Ohio.

WALTER H. RASTALL, formerly chief, Machinery Division, Department of Commerce, is now a manufacturer's agent in Washington, D. C., and is introducing certain special machinery into Government operations. He can be reached at 5357 Reno Road, N.W., and is available for additional representation, general as well as special.

WATCHING Washington

President realizes danger of rising tide of criticism on Court packing . . . Moves to jam measure through . . . Senate will be the scene of battle . . . Hearing set for March 9

WASHINGTON—"If, in the opinion of the people, the distribution or modification of the constitutional power be in any particular wrong, let it be corrected by an amendment in the way the Constitution designates—but let there be no changes by usurpation." From Washington's "Farewell Address."

Spontaneous and unorganized public opinion is rising against President Roosevelt's proposal to pack the Supreme Court. This is true despite strenuous propaganda put out by Administration sources in the last two weeks. It has caused congressmen to think twice before rubber stamping this most recent effort to concentrate power in the hands of the President.

Only 1 Per Cent for Change

One of the latest senators to declare himself against the proposal is Royal S. Copeland of New York. A count of 30,000 letters he received from constituents revealed that only 300, or 1 per cent, favored the change in the status of the Court. Forthwith the senator declared himself willing to do the will of the people back home. Other senators have been doing the same. Burton K. Wheeler, who has been sticking close to the New Deal fold, said, "If the members of the House or Senate voted their true convictions, there wouldn't be a chance in the world for this bill to pass either house." He also lambasted Attorney General Cummings and blamed him for exerting undue influence on the President. Senator Nye also came out against the measure after training a private seismograph on his home state. He said that Roosevelt had no mandate from the people to reform the courts, and had not proposed it in the campaign or in talks with congressional leaders.

It is now certain that the real battleground for the measure will be in the Senate. At the latest count 34 senators were opposed to it, 32 were for it, and 29 were not committed. Of the 29 each side claimed nine, leaving only eleven doubtful. Ironically, the Senate Judiciary Committee voted on Washington's Birthday to hold hearings on March 9, with Attorney General Cummings as lead-off witness. The Committee also voted to report the Sumners-McCarran Bill to permit justices to retire at 70. Some leaders are pressing for speedy passage, hoping that two or three members of the Court will step down and thus clear the road for a compromise on the most controversial part of the Rooseveltian scheme.

At first the Administration was willing to delay a vote on the Court-Reform Measure until a great outpouring of public approval could be generated. That the reaction would be the other way around was not anticipated and has proved a great blow to the President's prestige. Now he is aware that the packing job must be done quickly before genuine public opinion can effectively organize itself, and steps have been taken to force the Senate into line if at all possible. One of these is the consolidation of the farm vote and the labor vote behind the bill. In this he was rebuffed by the National Grange, the oldest farm organization, but has turned to the rather new American Farm Bureau Federation headed by Edward A. O'Neal, and whatever other farm support Secretary Wallace can bring into line. Major Berry is expected to deliver the vote of the Labor Non-Partisan League which will meet March 8 in time to hand out a pronouncement for the Senate Judiciary Committee the next day.

Just how effective an "organized" public opinion will be in influencing the members of the Upper House is still an unknown quantity. If enough regular Democrats oppose the Bill, their wishes are likely to have much more weight than a coerced mailing from farm and labor sources.

Many Labor Bills

President Roosevelt has repeatedly declared that a comprehensive labor program should be a prominent part of the current session's work. A number of bills are now before Representative Connery's House Committee on Labor. Among them are: H. R. 1, introduced by Representative Louis Ludlow, Indiana, which would create a federal industrial commission to aid in stabilization of employment; H. R. 62, by Representative Edith Nourse Rogers, Massachusetts, which would request the Secretary of Labor to make a census of children employed; H. R. 238, by Representative Ellenbogen, Pennsylvania, to provide minimum wages and maximum hours in the textile industry; H. R. 279 by Representative Celler, to establish unemployment insurance; Representative Connery has a number of labor bills, including H. R. 1606, to ban shipments in interstate commerce of goods made by workers working more than 30 hours a week; H. R. 1985 to extend the effect of any state labor laws to goods shipped into that state; H. R. 2685 to regular interstate commerce in child-labor products; H. R. 2880, which would make state laws as to working conditions, minimum wages to all goods shipped into the state interstate commerce; H. R. 2881, to create a federal licensing commission to license businesses in interstate commerce, and providing that no license shall be issued to firms employing labor more than 30 hours a week or children under 16 years old.

Business As Usual

Most lawyers expect the Supreme Court to declare the Wagner Labor Relations Act unconstitutional, and probably by a unanimous decision. That would be embarrassing to President Roosevelt's arguments for six additional justices, because even if all six new ones voted "yes" the verdict would still be 9 to 6 against. A compromise awarding two additional judges is looked for, which would make no difference except in the few close decisions.—*Carter Field, Washington Bureau, McGraw-Hill Publishing Co.*

Summer Conference on Mechanical Engineering

The Mechanical Engineering Division, Society for the Promotion of Engineering Education, will hold a conference on June 28-29 at Cambridge, Mass., to consider various phases of the teaching of mechanical engineering. This conference will precede the annual meeting of the Society. Further details of the conference will be announced later. Professor Frank L. Eidmann, Columbia University, is chairman.

National Aeronautic Meeting

A two-day National Aeronautic meeting, sponsored by the Society of Automotive Engineers, will be held at the Mayflower Hotel, Washington, D. C., March 11 and 12. This meeting is being held in cooperation with the Aeronautical Chamber of Commerce of America, the Air Transport Association of America, the American Society of Mechanical Engineers and the Institute of the Aeronautical Sciences. H. T. Woolson is president of the Society of Automotive Engineers, and Burton O. Lewis is chairman of the Washington Section.

Fuels, lubricants and vibration problems will be discussed at the morning and evening sessions on Thursday, March 11. The Friday morning and afternoon sessions will be given over to a discussion of practical aerodynamic problems, engine and aircraft design. Arthur Nutt, Wright Aeronautical Corp., will speak on "European Aviation Engines" at the reception and dinner to be held Friday evening.

JOHN P. SEYMOUR, 73, former works manager of the Carborundum Co., Niagara Falls, N. Y., died of a sudden heart attack recently in Buffalo. He retired in 1929.

Industrial Review

• FOLLOWING the explosion of orders in December and a very healthy carry-over in January it is not surprising that February business in machinery and machine tools in most industrial centers is smaller in volume. The Ohio valley floods and the General Motors strike were contributing factors in delaying the placing of orders. There is a general feeling, however, that the lull is temporary and that business during the next three or four months will be decidedly active.

• PROSPECTS in the New England territory are believed to be as good as ever despite the handicap of delayed deliveries which held down February business. New York reports a similar situation and notes the release of several railroad lists, something that has not happened for some time. Business maintained a good level in Philadelphia although the level was not as high as in January and December. Pittsburgh is somewhat jumpy wondering whether C.I.O. will make an early attack on the steel industry. In the meantime business is proceeding at a good rate.

• IN CLEVELAND machine tool distributors report that their customers have apparently recovered from the flood and strike upsets. In Detroit, of course, machine tool and shop supply distributors are very busy catching up with the resumption of activities in the General Motors Plants. February promises to be much better than January in this territory. Inquiries are active in Toledo and some business is being placed.

• WHILE CINCINNATI machine tool plants are struggling to catch up with deliveries and recover from the effects of the flood they report that February business is not on the January level. Although there was some friction when the G.M.C. plants in St. Louis resumed operations, these difficulties have apparently been straightened out and business is active. With the exception of the Fansteel strike there are not serious labor troubles in the Chicago area and business is continuing on an active basis. Milwaukee has been going along at a fairly even pace and expects good business for the remainder of the first half of 1937.

• BUSINESS IS BOOMING on the Pacific Coast where machine tool orders placed during the last six months exceed those placed in any twelve month period during the last twelve years. February was the record month. Los Angeles is going strong because of the stimulation coming from airplane manufacturing, the oil industry and the many small plants that are being established there.

Amos E. Northup Dead

Injuries resulting from a fall on an icy street caused the death of Amos E. Northup, well known automobile stylist, in Detroit on Feb. 15. Mr. Northup was 48 years old and, for the past ten years has been chief designer for the Murray Corp. of America. Many of the body styles of present day automobiles are either the result of his work or are traceable back to his creations. Among the new models created by him is the 1938 Graham, not yet announced to the public.

GEORGE REID RICHARDSON, president and general manager of the Richardson Boat Co., N. Tonawanda, N. Y., died February 17 of a heart attack. He was 57. Mr. Richardson headed one of the leading firms engaged in manufacturing of power cruiser boats and was active in the affairs of the National Association of Engine and Boat Manufacturers.

ROBERT W. GOTSHALL, general sales representative for the Caterpillar Tractor Co., and a pioneer in the development of the track-type tractor and road machinery, died February 11 after a long illness. The first "caterpillar" track-type tractor to be built east of the Rocky Mountains was produced under Mr. Gotshall's supervision at the Union Iron Works in Minneapolis.

J. B. MILLS, factory manager of the Ohmer Fare Register Co., for the past seventeen years, was elected a director at the annual meeting of the stockholders on February 8. The officers of the company are as follows: JOHN F. OHMER, president; H. B. OHMER, vice-president and treasurer; JOHN F. OHMER, JR., vice-president; R. L. HUBLER, vice-president; I. F. LUTZ, secretary.

FRANKLIN G. SMITH, who has completed 45 years as the executive head of The Osborn Manufacturing Co., Cleveland, was honored on January 30 by a luncheon at the Union Club at which many leaders in the industrial, financial, legal and educational field were present.

NELSON F. CALDWELL, European manager of the Cincinnati Milling Machine and Cincinnati Grinders, Inc., has returned to his Paris headquarters after a two-months stay in the United States. He has managed the Cincinnati concern's European interests for the past eight years.

Detroit LETTER

General Motors is still being sniped at by union which is now going after parts makers . . . Turmoil creates uncertainty about tooling programs, but some may go through . . . 5,000,000 car year possible

DETROIT — The motor industry wouldn't be surprised if the settlement of the General Motors strike proved to be the beginning rather than the end of labor trouble. The United Automobile Workers weren't sure of their strength when they entered the big strike, but they come out of it with at least part of what they want after. The effect has been to redouble their efforts to unionize the industry and to attack parts manufacturers on a wide front, demanding recognition.

That the union will seek out an adversary the size of either Ford or Chrysler the remainder of the current model year appears unlikely. John L. Lewis will be fully occupied for some time in the coal and steel industries. Moreover, the financing of one mammoth automobile strike a year is about all that the youthful union can manage. It is more likely that attention will be riveted on strengthening union membership in General Motors plants and in bringing parts companies into the fold. Results secured at the Ainsworth Mfg. Co. are what the union is aiming at throughout the parts industry. Ainsworth has granted recognition to the U.A.W., accepted its system of plant stewards, pledged itself to a 40-hour week and a minimum wage of 75 cents an hour.

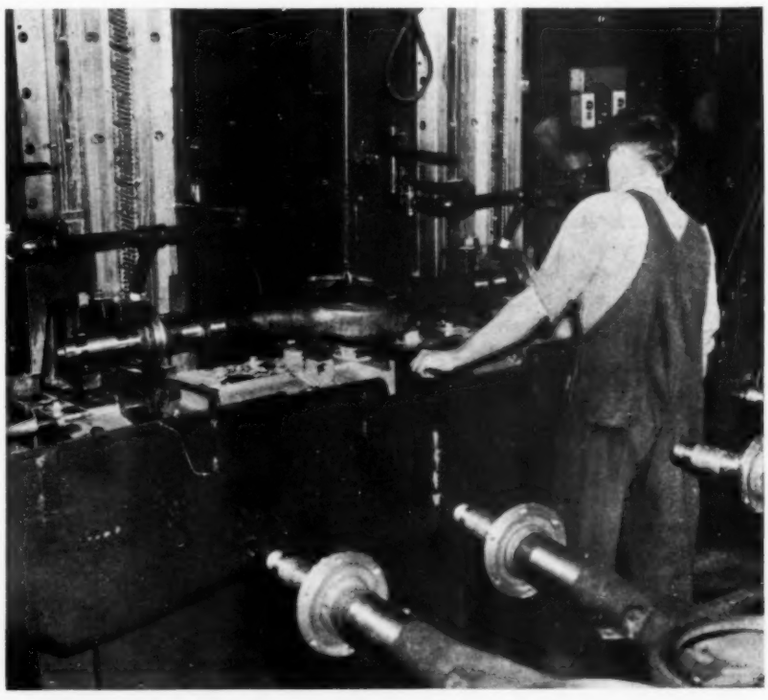
Plagued Incessantly

It begins to look like General Motors has let itself in for the same trouble which followed the Goodyear strike in Akron a year ago. It will be remembered that Goodyear has been plagued almost daily with disturbances and petty sitdown strikes in individual departments which interrupted production and caused bad feeling, not to mention an inevitable letdown in plant efficiency. General Motors already has had a one-day sitdown strike at the St. Louis plants of Chevrolet and Fisher Body. Relations between union and non-union men at Flint can hardly be called friendly. Accusations of bad faith are made on both sides. The corporation says union workers are deliberately engaging in a campaign to slow down production; the union, on the other hand, charges that lines have been unduly speeded up. And so the indignation is heard far into the night. Nevertheless negotiators have stuck steadfastly by their tasks of arriving at an understanding on such matters as seniority, day rate versus piece work, an adequate wage "commensurate with the American standard of living," and the maximum basic work-week (the union wants the 30-hour week).

This turmoil in which the industry finds itself, with each manufacturer never knowing where the union lightning will strike next, is scarcely conducive to the making of long-term plans. It doesn't encourage manufacturers to dig down in their pockets and bring out huge expenditures for new tooling programs. There is, however, one point on which all automotive executives are agreed — labor costs will rise in the months ahead and a major task will be to keep manufacturing costs down as much as possible. Obviously the best way to do this is to install high-production equipment.

Tooling Held Up

General Motors executives have been completely absorbed in the strike and lately in attempts to get production back up to a high rate as quickly as possible. They have had little time to think about tooling plans for next year. Whether G.M.



Parallelism Assured—Two single-ram Colonial broaching machines are set up in the Chevrolet Gear & Axle Plant for producing a flat 3/8 in. wide by 4 in. long on one side of both rear axle flanges. The extra-wide broaches permit three adjustments of fixture location before resharpening

divisions will go through with programs on which they were working prior to the strike is anybody's guess. The Buick plans, for example, are yet to be determined, although they were well advanced at the start of the strike. Chevrolet was prepared to buy gear-cutting machinery for its Saginaw and Muncie factories in January, but the strike's intervention made necessary a postponement. Nothing has been done thus far.

The big strike gave Chrysler a bad scare. It is understood to have abandoned entirely a sizable equipment buying program which it had contemplated for its Dodge Division. Chrysler has asked for quotations on additional machine tools for its engine line at Jefferson Avenue.

The telegram sent to the Chrysler Corporation officials by U.A.W. leaders demanding recognition as the sole bargaining agency in all Chrysler plants was based on the confidence that the Union is stronger in Chrysler than in either General Motors or Ford. On the basis of this belief labor leaders expect to get what they want without a strike.

Whether Plymouth is to spend much money is undecided. Packard is going ahead by leaps and bounds. It built 52,186 cars from Sept. 1 to Feb. 1 and in March and April expects to make 15,000 cars a month. It never before has approached that figure.

Automatic Transmissions

No new motors, requiring large capital outlays for equipment, are looked for in '38. Much money was spent the past year by Chevrolet, Packard, Chrysler and Oldsmobile for new or revamped engines. Most likely changes will be in transmissions. Oldsmobile and Buick, it will be recalled, were on the verge of using an automatic transmission on 1937 models but backed out at the last moment. The same transmission is available for next year and Buick, with a new transmission plant, is set up to make it if high corporation officials give the "go ahead." Pontiac is reported playing with an overdrive which it may adopt for '38. Not much has been heard lately about overdrives, which were pioneered by Chrysler, but it is said that their popularity has been growing without the usual sales ballyhoo. The story is that Chrysler may again put promotional pressure on the overdrive feature.

Despite progress in that direction, the time hasn't yet arrived when the entire side of a car body can be stamped out of a single steel sheet. As steel mills capable of rolling extra-wide stock are established, the use of wider sheets will grow. This trend isn't disturbing the makers of presses who already are building huge presses more than capable of handling the size of sheets which will be specified in the next year or two. Beds of these presses will take sheets 100 inches wide and 180 inches long.

General Motors is snapping into full-time operations with commendable rapidity. Pontiac, for example, had 35 cars an hour coming off its final assembly lines by Feb. 17 (the strike was settled Feb. 11). Pontiac took advantage of the shutdown during the strike to enlarge its final assembly line so that it can build 1,700 to 1,800 cars a day. General Motors hopes to manufacture 225,000 cars and trucks during March.

Production Expands

Even after being bogged down by the General Motors strike, the industry is well on its way to production of at least five million cars this year. Both January and February showed a gain in output over last year and the projected schedule for March is for 525,000 units. The first quarter total should be about 1,250,000 units. There is no reason to believe that the initial quarter's production this year will be more than 24 per cent of the year's total. If that holds true, then the year's assemblies should be around 5,200,000 cars.

British Machine Tool Exports and Imports

During the year 1936 Great Britain exported 13,888 tons of machine tools valued at £2,013,964. Imports during the same period weighed 19,866 tons and were valued at £3,602,031. It will be seen that the value of net imports (imports less re-exports) exceeded the value of the exports by approximately 75 per cent. Tables I and II, shown here, indicate the totals in the various classes of tools exported and imported.

The table for exports once again shows the predominance of the lathe class, which forms nearly one-third of the total value. The average value of £145 per ton shows a slight increase over similar value for 1935. On the basis of value per ton, lathes and drilling machines as a whole were of about average value, while the value for both grinding machines and milling machines was high.

It will be seen in Table II that the lathe class accounts for a little more than a quarter of the total value of machines imported. While the average value per ton of £181 for imports is definitely higher than the corresponding figure for exports, this is a reduction as compared with 1935 when the average value per ton of the imports was £220. This is largely accounted for by the low ton values of the presses and sawing machinery imported.

TABLE I—EXPORTS

Machine Tools (metal-working)	Quantity	Value	Value per ton
	Tons	£	£
Boring mills	1,825	204,520	112
Drilling	1,379	204,514	148
Grinding	1,434	259,267	180
Lathes	4,606	658,514	143
Milling	361	65,268	181
Planing and shaping	1,327	140,580	106
Presses, punching and shearing	762	59,280	78
Other	2,194	422,021	192
Total	13,888	2,013,964	145

TABLE II.—IMPORTS

Machine Tools (metal-working)	Quantity	Value	Value per ton
	Tons	£	£
Boring mills	858	156,485	182
Drilling	626	141,671	226
Grinding	2,123	525,863	247
Lathes	4,641	996,502	213
Milling	3,003	613,848	204
Planing and shaping	609	100,128	164
Presses, punching and shearing	2,885	281,421	98
Sawing	235	35,983	150
Other	4,886	750,130	154
Total	19,866	3,602,031	181

PERSONALS

ROY W. JOHNSON, formerly factory superintendent has been elected vice-president of the Atlantic Screw Works, Hartford, Conn., to succeed the late MORTON F. MINER. SAMUEL M. MONKS, assistant secretary, succeeds Mr. Miner as secretary.

R. B. RENNER, who has been with the Jeffrey Manufacturing Co., for the last 30 years as mechanical engineer, was recently made chairman of the executive committee of the Materials Handling Division, American Society of Mechanical Engineers. The function of this division of the Society is to spot, coordinate and bring before the engineering public outstanding developments in conveying machinery and its use.

DON J. LUTY has been made assistant general manager of the Air Conditioning Division, Gar Wood Industries, Inc., Detroit, according to an announcement by FRANK H. DEWEY, general manager. NORMAN SAYLOR has been made manager of the company's Detroit branch. Mr. Luty has been connected with the company for many years as chief engineer, while Mr. Saylor joined the Air Conditioning Division last year.

FRANK CORDES, president of the Blaw-Knox Co., Blawnox, Pa., was recently elected chairman of the board and CHESTER H. LEHMAN, vice-president, was elected vice-chairman of the board and executive vice-president. WILLIAM P. WITHEROW is the new president. He has had considerable experience in steel mill and general engineering practice and has been a member of the board for some time.

C. W. SIMPSON, vice-president and works manager of the National Acme Co., Cleveland, Ohio, left for Europe on Feb. 8 for an eight weeks' business trip.

L. E. MURPHY, for years chairman of the board of E. F. Houghton & Co., Philadelphia, Pa., has retired and the office has been temporarily discontinued. MAJOR A. E. CARPENTER continues as president.

GEORGE C. MOON has been made a vice-president and director of the American Chain & Cable Co., Inc., Bridgeport, Conn., but with headquarters at 230 Park Ave., New York.

CHARLES E. MCQUIGG, director of research for the Union Carbide & Carbon Co. since 1934, has been made dean of the college of engineering of Ohio State University as of July 1.

ALBERT BRAUSS has been appointed chief inspector of the Inland Manufacturing Division, General Motors Corporation, Dayton, Ohio. He started with Inland in March 1930 as a draftsman.

HENRY OTZMANN, formerly with the Bethlehem Steel Corp., has been employed by the E. A. Williams & Son, Elizabeth, N. J., manufacturers of bronze castings, and oil-less and plain bronze bushings, as general superintendent of the machine shop division.

BUSINESS ITEMS

The Dardelet Threadlock Corp. has removed its New York offices to 55 Liberty St.

The Lincoln Electric Co. has appointed D. J. BRUGGE, who spent two years in superintending welding operations in the Near East, to the sales staff of its Los Angeles office. For several years he was employed in the Lincoln Research Laboratory working on carbon arc and manual welding problems.

Goddard & Goddard, Inc., Detroit, manufacturer of cutters, was awarded the Morrison trophy in the sixteenth annual Inner-Plant Safety Contest, conducted by the Detroit Industrial Safety Council during 1936. The company operated without a single accident last year.

The Van Norman Machine Tool Co., Springfield, Mass., has completed installation of new machinery in a new plant addition, according to James Y. Scott, president.

Chapman Machine Co., Terryville, Conn., has completed construction of a new addition which doubles the floor space. Plans call for the eventual purchase of new machinery for installation in this addition.

Electric Soldering Iron Co. and Health Ray Lamp Corp., New York, N. Y., both owned by LEONARD YOUNG, will be moved to Deep River, Conn., where manufacturing will be carried on in the former plant of Pratt, Read & Co.

Risdon Manufacturing Co., Naugatuck, Conn., has acquired the Consolidated Safety Pin Co., Bloomfield, N. J., from the Chase Brass & Copper Co. Part of the business will be transferred to Waterbury and part to Naugatuck. LEWIS A. DIBBLE is president of the Risdon Mfg. Co.

The Westinghouse Electric & Mfg. Company will move its Pittsburgh office and some of the general offices now located at East Pittsburgh, to the Union National Bank Building, in Pittsburgh.

The Ideal Commutator Dresser Co., 1439 Park Ave., Sycamore, Ill., has acquired the Marshall Electric Co., Elkhart, Ind., manufacturers of automatic regulators for voltage, current and speed control of electrical equipment.

The Phoenix Ice Machine Co., 2703-2711 Church Ave., Cleveland, Ohio, has taken over manufacture and sale of Lester die-casting machines which are being built in accordance with drawings and patents owned by the Lester Engineering Co.

OBITUARIES

Vincenzo Lancia Dies, Itialian Auto Maker

Vincenzo Lancia, owner-president of Lancia & Co., and one of Italy's leading automobile manufacturers, died suddenly, February 15, in Turin, Italy. Mr. Lancia started his business with a small capital and built it up until it now stands as the second largest Italian firm building passenger cars, trucks and airplane engines.

He pioneered the independent front wheel suspension construction, and was one of the first to build cars with the chassis and body in one unit. As a young man he was a race track driver and competed in many races in the United States. Funds secured in the international automobile races were used to build up his own factory. He made it a rule to invest money not needed for actual production in the improvement of his plants.

DAVID T. WADSWORTH, vice-president of the Wadsworth Electric Mfg. Co., Covington, Ky., manufacturers of switches and lighting units, died recently.

H. C. LITTLE, formerly purchasing agent and assistant manager of the Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, died Feb. 6.

CLARENCE R. STROHM, vice-president of Underwood Elliot Fisher Co., office equipment manufacturers, and a director of several other concerns, died suddenly in his New York offices on Feb. 17.

Machine Tool Census Shows Rapid Recovery by Industry

1935 Production Double That of Depression Low

Biennial figures from the machine tool industry, as given in the preliminary report of the Census of Manufacturers, show that the dollar value of products for this industry in 1935 was 194 per cent ahead of 1933. The figures are $121,832,570 for 1935, and $41,433,523 for 1933. The year 1935 was also better than 1931, when the total value of output was $81,286,568.

The gain in machine tools proper, (excluding other products, and receipts for contract and repair work) was even more spectacular—258 per cent. The 1935 total was $83,077,076; the 1933 total $23,266,205.

In comparison with 1929, the position of the industry in 1935 was still far from peak output. Total value of the products of the industry according to the 1929 census was $244,578,088, and of machine tools proper $176,426,454. The drops in 1935 were 50.1 per cent and 52.8 per cent respectively.

In tune with rising production, wages paid out in 1935 by the machine tool industry were 197 per cent ahead of 1933, the amounts spent for materials 245 per cent, and the value added by manufacture 180 per cent. Employment gained 121 per cent.

The value of output of individual kinds of machines is as follows: boring machines, $3,830,832; broaching machines, $825,096; drilling machines, $6,853,089; honing machines, $413,489; forging machines, $2,064,553; gear cutting machines, $4,612,029; grinding machines, $12,689,938; lathes (all types), $19,874,805; milling machines, $6,955,683; planers, $552,998; presses, $6,090,945; shapers, $920,671; shears, $783,809; threading machines, $1,985,757.

The machine tool industry, as constituted for census purposes, embraces establishments engaged primarily in the manufacture of power-driven machines generally covered in the designation "machine tools." Certain types of machines designed for working metal, especially sheet-metal-working machines, welding machines, wire drawing machines, and wire-working machines, do not come within the scope of this classification and consequently are assigned to other industries.

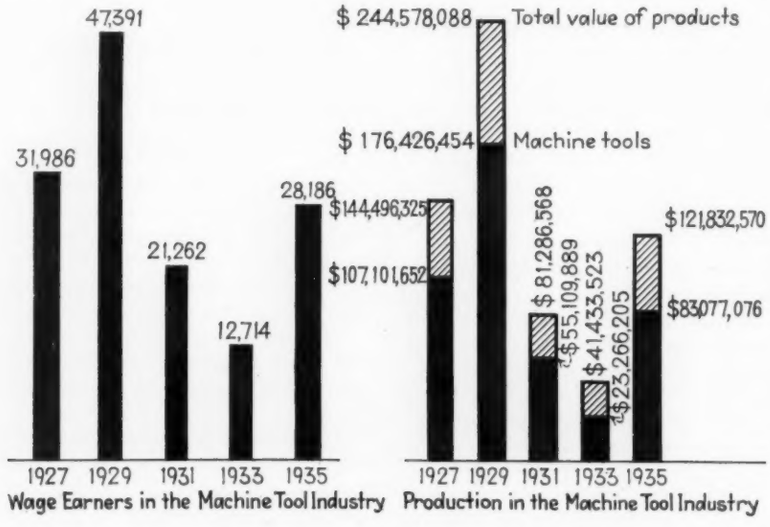


Table I.—Summary for the Industry: 1935, 1933, and 1931

(Because they account for a negligible portion of the national output, plants with annual production valued under $5,000 have been excluded since 1919)

	1935	1933	1931	Percent of increase or decrease (—) 1933–1935	Percent of increase or decrease (—) 1931–1935
Number of establishments	259	232	279	11.6	—7.2
Wage earners (average for the year) [1]	28,186	12,714	21,262	121.7	32.6
Wages [2]	$37,260,565	$12,596,212	$25,149,816	195.8	48.2
Cost of materials, fuel, and purchased electric energy [3]	$36,347,430	$10,844,323	$21,900,879	235.2	66.0
Value of products [3]	$121,832,570	$41,433,523	$81,286,568	194.0	49.9
Value added by manufacture [3]	$85,485,140	$30,589,200	$59,385,689	179.5	43.9

[1] Not including salaried officers and employees. Data for such officers and employees will be included in a later report. The item for wage earners is an average of the numbers reported for the several months of the year. In calculating it, equal weight must be given to full-time and part-time wage earners (not reported separately by the manufacturers), and for this reason it exceeds the number that would have been required to perform the work done in the industry if all wage earners had been continuously employed throughout the year. The quotient obtained by dividing the amount of wages by the average number of wage earners cannot, therefore, be accepted as representing the average wage received by full-time wage earners. In making comparisons between the figures for 1935 and those for earlier years, the possibility that the proportion of part-time employment varied from year to year should be considered.

[2] Profits or losses can not be calculated from the census figures because no data are collected for certain expense items, such as interest, rent, depreciation, taxes, insurance, and advertising.

[3] Value of products less cost of materials, fuel, and purchased electric energy.

Machinery Exports Show Large Increase in 1936

Machinery exports for 1936 aggregated $169,836,427. This is a 30 per cent increase over the 1935 shipments, which were valued at $130,272,591, according to a report issued by the Machinery Division, Department of Commerce. Foreign sales increased in all machinery groups, the gains ranging from 7 per cent in power-generating machinery to 55 per cent in metal-working machinery.

Exports of practically all types of power-driven metal-working machinery advanced during the year, the total value reaching $41,896,692, an increase of $14,806,020 over the 1935 total. The sharpest increase took place in the shipments of sheet and plate metal-working machines which advanced by 137 per cent during the year.

Other metal-working machinery shipped abroad during 1936 reached the value of $4,220,557, approximately 59 per cent above the corresponding shipment in 1935. All items showed a gain, but particularly the machine-operated cutting tools in which shipments, valued at $1,602,529, were more than double those in 1935.

Exports of machinery from the United States in December were valued at $15,810,281 which is an increase of 28 per cent above the December 1935, shipments, which were valued at $12,360,766. The increase during December was fairly general and spread over all but one of the eight machinery groups.

Table 2—Products, by Class, Number, and Value: 1935 and 1933

	1935		1933	
	Number	Value	Number	Value
1. "Machine Tools" industry, all products, total value	....	$121,832,570	....	$41,433,523
2. Machine tools	....	83,077,078	....	23,266,205
3. Replacement and repair parts	....	11,570,873	....	5,694,269
4. Other products (not normally belonging to the industry), value, and receipts from sale of electric energy	....	23,871,509	....	11,210,363
5. Receipts for contract and repair work	....	3,313,112	....	1,262,686
6. Machine tools made as secondary products in other industries	....	1,991,775	....	[1] 670,027
Machine tools, aggregate value (2 and 6)	....	85,068,851	....	[1] 23,936,232
Bending machines	629	581,755	343	226,358
Boring machines:				
Horizontal	321	1,592,222	98	440,164
Vertical:				
Number reported	24	306,607	20	78,563
Number not reported	....	33,670	....	.....
Special types:				
Boring, drilling, and milling combined	80	1,178,337	[2]	374,215
Boring and turning combined	36	321,469		
Other, including jig borers	94	719,996		
Broaching machines (other than keyseaters):				
Number reported	219	668,210	[2]	[2]
Number not reported	....	156,886		
Cutting-off machines (see end of table)				
Drilling machines:				
Horizontal:				
Number reported	140	704,159	[2]	304,017
Number not reported	....	269,927	....	.....
Vertical:				
Multiple-spindle other than sensitive:				
Number reported	360	1,143,979	45	154,137
Number not reported	....	64,333	....	.....
Standard	661	398,642	233	165,132
Sensitive (including bench type):				
Single-spindle:				
Number reported	8,398	450,295	[3] 218	[3] 37,018
Number not reported	....	205,092	....	.....
Multiple-spindle	428	613,466	56	62,268
Radial:				
Number reported	250	774,272	[2]	304,106
Number not reported	....	324,426	....	.....
Combined vertical and horizontal	42	252,966	[2]	669,237
Drilling and tapping	....	752,036		
Other special, including combined vertical and horizontal, automatic, and universal-head:				
Number reported	173	539,392		
Number not reported	....	360,104		
Honing machines:				
Number reported	118	383,129	55	125,320
Number not reported	....	30,360	....	.....
Forging machines:				
Drop hammers and presses (impression-die)	71	494,290	[2]	477,104
Forging hammers (flat-die):				
Number reported	18	41,147		
Number not reported	....	11,422		
Other, including bulldozers and upsetters	....	1,517,694		
Gear-cutting machines	896	4,612,029	[2]	1,029,765
Grinding machines:				
External-cylindrical	618	3,185,921	319	1,045,153
Universal	208	646,973		
Surface	1,110	1,931,889	167	329,743
Cutter and tool	575	712,928	172	203,606
Internal-cylindrical	503	2,588,024	[2]	2,048,158
Drill	302	101,564		
Snagging or tool grinders (hand), wet or dry	1,188	73,556		
Other, including disk	....	3,449,083		
Latches:				
Bench (plain and screw-cutting)	12,072	1,125,477	3,283	1,424,973
Engine:				
General-utility:				
Capacity 16" swing and under	1,935	2,249,289		
Capacity over 16" swing and including 22"	504	1,058,129		
Capacity over 22" swing and including 36"	96	490,311		
Heavy-duty over 36" swing	14	157,869		
Gap	18	32,923		
Automatic single-spindle:				
Bar and chucking:				
Number reported	823	2,298,028	242	1,185,205
Number not reported	....	959,174		
Automatic multiple-spindle:				
Bar:				
Number reported	511	2,971,756		
Number nor reported	....	632,103		
Chucking:				
Number reported	294	2,548,015		
Number not reported	....	576,818		
Turret:				
Horizontal hand-operated:				
Ram-type	633	1,491,427	201	516,372
Saddle-type, standard and heavy duty:				
Number reported	290	1,699,923		
Number not reported	....	413,789		
All other lathes, including vertical-turret, polishing and buffing (bench and pedestal), and hand or speed	[2]	1,169,774	[2]	851,386
Milling Machines:				
Plain	410	990,427	135	359,515
Universal	582	1,608,090	120	294,569
Vertical	406	1,410,536	69	191,294
Planer type	81	675,325	[2]	495,893
Other, including automatic and Lincoln-type:				
Number reported	651	2,441,181		
Number not reported	....	30,124		
Planers (see end of table)				
Portable tools:				
Drills:				
Electric:				
Number reported	68,388	2,380,524	19,091	775,357
Number not reported	....	.....	....	94,169
Pneumatic:				
Number reported	7,449	1,035,621	5,024	633,488
Number not reported	....	1,457,340	....	.....
Grinders:				
Electric:				
Number reported	20,764	917,075	5,968	200,541
Number not reported	....	.....	....	60,025
Pneumatic	4,533	486,264	2,344	205,698
Hammers (chipping, riveting, calking, etc.):				
Electric	965	115,932	428	60,821
Pneumatic:				
Number reported	11,833	714,173	10,824	568,456
Number not reported	....	156,359	....	.....
Other (including portable motor driven garage equipment), and those not reported by kind:				
Number reported	14,737	790,748	[2]	2,302,836
Number not reported	....	3,624,882		
Flexible-shaft:				
Number reported	2,563	289,760		
Number not reported	....	188,100		
Presses (except forging presses):				
Forging and stamping:				
Number reported	1,635	3,912,867	755	1,105,799
Number not reported	....	556,953	....	325,767
Punch:				
Number reported	376	515,417	[2]	99,971
Number not reported	....	112,776	....	.....
Other	....	931,231	[2]	164,060
Punching machines (see end of table)				
Riveting machines (not portable):				
Number reported	486	128,012	....	55,185
Number not reported	....	67,429		
Shapers:				
Vertical and slotters	76	208,733	35	58,458
Horizontal:				
20" stroke and under	247	401,033		
Over 20" stroke and including 28"	81	179,987		
Over 28" stroke	58	130,918		
Shears				
Alligator, rotary, and combination punch and sheer	175	189,450	105	124,022
Straight	482	549,253		
Other, including hand-lever and foot-power (see end of table)				
Threading machines:				
Other than pipe-threading:				
Die and rolling types	316	426,984	134	132,293
Milling type	36	188,812		
Tapping machines:				
Number reported	313	321,996		
Number not reported	....	251,563		
Pipe cutting and threading machines:				
Single-head	718	656,525	[4] 359	198,934
Multiple-head (number not reported)	....	139,877		
Cutting-off machines:				
Band-saw	75	52,453	....	3,437,083
Hack-saw	879	344,754		
Other, including cold-saw	43	128,264		
Planers:				
Standard, over 36"	16	251,439		
Open-side	25	172,989		
Other, including standard 36" and under	101	128,570		
Punching machines (not portable)	....	61,701		
Shears, other than those specified above, including hand-lever and foot-power:				
Number reported	522	39,398		
Number not reported	....	5,708		
All other machine tools	....	2,834,243		

[1] Revised.
[2] No comparable data.
[3] Not strictly comparable with corresponding figure for 1935 because of changes in the form of the questionnaire used in canvassing this industry
[4] Estimated in small part.

MEETINGS

ASSOCIATION OF IRON AND STEEL ENGINEERS. National meeting, Ohio Hotel, Youngstown, Ohio. Feb. 25.

CHAMBER OF COMMERCE OF THE UNITED STATES. Twenty-fifth anniversary meeting. Washington, D. C. April 26-29. D. A. Skinner, secretary.

CHICAGO NATIONAL BOAT & SPORTS SHOW. Navy Pier. Feb. 28-March 7. H. H. ERICKSON, manager, Navy Pier, Chicago.

KNITTING ARTS EXPOSITION. Commercial Museum, Philadelphia. April 19-23. A. C. RAU, secretary, 327 Park Square Bldg., Boston.

NATIONAL OIL BURNER & AIR CONDITIONING EXPOSITION. Philadelphia, Pa., March 15-19. C. F. CURTIS, secretary, 30 Rockefeller Plaza, New York.

NATIONAL RAILWAY APPLIANCE EXHIBITION. Chicago, Ill. March 15-18. C. W. KELLY, 910 S. Michigan Ave., Chicago.

PACKAGING EXPOSITION. Hotel Penn, New York. March 23-26. Show managers — Roberts Everett Associates, 232 Madison Ave., New York.

EXPORT OPPORTUNITIES

* Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office. Please refer to key number.

Glass lens and mirror grinding machines. (Purchase). Prague, Czechoslovakia. *2422.

Milk-pasteurizing equipment. (Purchase.) Habana, Cuba. *2449.

Mining machinery and equipment for placer and lode mining, compressors and pumps. (Agency.) Manila, P. I. *2430.

Oil eucalyptus manufacturing machinery (small plant). (Purchase.) Lima, Peru. *2457.

Pneumatic air hammers, and electric welding outfits. (Purchase.) Frankton, New Zealand. *2448.

Weaving machines for making sisal cloth, and sewing machines for making sacks. (Purchase.) Lima, Peru. *2457.

Alcohol-distilling equipment, and sugar milling machines and equipment. (Agency.) Rio de Janeiro, Brazil. *2506.

Dairy machinery, including cream separators, pasteurizers, and coolers. (Purchase.) Sao Paulo, Brazil. *2497.

Lumber sawing and planing machinery and equipment for manufacture of plywood and pulpwood, including hydraulic presses and steam roller and drying plant. (Purchase.) Johannesburg, South Africa, *2521.

Paper-manufacturing machinery (Purchase.) Mexico City, Mexico. *2505.

Power plants, hydroelectric, machinery and equipment. (Purchase.) Manila, P. I. *2489.

Roofing tile, cement, manufacturing machine. (Purchase.) San Salvador, Salvador. *2508.

Washing machines and equipment for fire-fighting brigades. (Purchase and Agency.) Prague, Czechoslovakia. *2504.

PATENTS

February 2, 1937

Metal-Working Machinery

Apparatus for Making Dished Heads. Charles B. Cushwa, Youngstown, Ohio. Patent 2,069,198.

Machine Tool and Method (Horizontal Boring and Milling). Raymond M. Woytych, Fon du Lac, Wis., assigned to Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Patent 2,069,296.

Milling Machine. Howard W. Bartholomew, Pottstown, Pa., assigned to Doehler Die Casting Co., Toledo, Ohio. Patent 2,069,299.

Helical Gear Shaping Machine. Edward W. Miller, Springfield, Vt., assigned to The Fellows Gear Shaper Co., Springfield, Vt. Patent 2,069,323.

Gear Lapping Machine. Edward W. Miller, Springfield, Vt., assigned to The Fellows Gear Shaper Co., Springfield, Vt. Patent 2,069,324.

Apparatus for Pointing Corners. Howard C. Underwood and Edward B. Roby, New York, N. Y. Patent 2,069,341.

Parts and Mechanisms

Control Element for the Flushing Device in Hydraulic Gears. Otto Heerdt, Leipzig, Germany. Patent 2,069,366.

Safety Shield (for Grinders). Herbert E. Tautz, Milwaukee, Wis., assigned to The Delta Mfg. Co., Milwaukee, Wis. Patent 2,069,395.

Antifriction Screw. Donald J. Baker, Pasadena, Calif. Patent 2,069,471.

Upsetting Mechanism. Richard Lester Wilcox, Waterbury, Conn., assigned to the Waterbury Farrel Foundry and Machine Co., Waterbury, Conn. Patent 2,069,511.

Processes

Nickel Plating Solutions and Processes. Robert L. Tuttle, Woodbridge, N. J., assigned to Zialite Corp., New York, N. Y. Patent 2,069,566.

Arc Welding. Lionel G. Pickhaver and William W Worley, Jr., Chicago, Ill., assigned to General Electric Co., Schenectady, N. Y. Patent 2,069,623.

Tools and Attachments

Hand Punch. Edward H. Findlay, Pomona, Calif. Patent 2,069,231.

Lathe Attachment. Irving Cooperstein, Brooklyn, N. Y., assigned one-half to Abraham Cooperstein, Brooklyn, N. Y. Patent 2,069,356.

Follow Rest. Edwin R. Smith, Seneca Falls, N. Y., assigned to Seneca Falls Machine Co., Seneca Falls, N. Y. Patent 2,069,426.

Automatic Control for Machine Tools. Oren G. Rutemiller, Wilkinsburg, and Thomas H. Long, Irwin, Pa., assigned to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Patent 2,069,508.

Chuck Adapted for Stud Driver or the Like. Arthur I. Kirkland, Detroit, Mich. Patent 2,069,527.

Automatic Gauging Stop for Shearing Machines. Myron A. Palmer, Wellsville, N. Y., assigned to The Air Preheater Corp., New York, N. Y. Patent 2,069,536.

Wrench. Fred M. Justice, Brewton, Ala. Patent 2,069,582.

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February 9, 1937

Metal-Working Machinery

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Method of Cutting Gears. Ernest Wildhaber, Rochester, N. Y., assigned to Gleason Works, Rochester, N. Y. Patent 2,070,191.

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DOUBLE, DOUBLE—

By Berton Braley

"To double production," the Old Un said
"Is a difficult job to do,
And, as I figure it in my head,
In order to see it through,
You double your men and space—and then
You double equipment, too!

"For such a task I would have to ask
To double the rate of pay
With a piece rate lift and a double shift
With double the time each day,
And of course I'd need to double the speed
It's the only possible way!"

"To double production," the Young Un said
Need lead to no vast expense,
Unless you spend your money instead
Of common, or garden, sense—
To handle the job you must use your knob
With Double Intelligence!

"Throw out the junk that is old and punk,
Modernize each machine,
Make the best of the skill and zest
Of a personnel that's keen,
For a double task the thing to ask
Is a doubly functioning Bean!"

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Dies That Melt

The use of low melting point metals for temporary forming dies has some startling features. We recently saw such a punch and die that were about 30-in. long. They look very substantial and are heavy. So it is hard to realize that if you drop them into hot water they melt at once!

How Many All-round Mechanics?

FRANK C. HUDSON

There are frequent reports of a shortage of skilled men. Does it mean all-round mechanics or skilled specialists? How many all-round mechanics do we need?

Small repair shops, small contract shops and shops with inadequate equipment may need all-round men, men who can not only run any machine in the shop, but be ingenious enough to fudge up methods of doing the all but impossible jobs that come along. Few such shops can afford to pay what a good man is worth.

The tool shop, which makes jigs, fixtures and the like, rarely has one man build the complete fixture, unless it is a small shop. Average size tool shops divide the work up between lathe, planer, drilling and milling machine hands, gear cutters, and other specialists. As in manufacturing they particularly need first class operators on the different machines. Which again prompts the question, how many all-round mechanics do we need?

Jigs and Fixtures

Two of the most common shop terms are jigs and fixtures—yet there are still differences of opinion as to whether they are interchangeable or which is which. Webster uses only one word "jig," to cover them all.

There's
DOLLARS and "SENSE"
LOGIC in SPECIFYING
WYCKOFF
COLD FINISHED
STEELS
LOGICAL because Wyckoff Cold Drawn Steels enable you to reduce machining operations and thus cut dollars from production costs and add them to profits. It is the one kind of steel that meets the most exacting standards as to accuracy of size and shape . . . uniformity of cross section . . . straightness and smooth finished surface—a refined steel that combines precise physical and chemical analyses.
In addition to the standard Wyckoff Rounds, Squares and Hexagons, we have a most complete line of special shapes including w-i-d-e Flats up to 12" x 2".
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General Offices: First National Bank Building, Pittsburgh, Pa.
Mills at Ambridge, Pa. and Chicago, Ill.
Manufacturers of Carbon and Alloy Steels
Turned and Polished Shafting
Turned and Ground Shafting
Wide Flats up to 12" x 2"

Some use jig in connection with drilled work only, but this is not universal by any means.

One distinction which has considerable logic, is to designate as a jig any work-holding device that is not fastened to the machine, but simply rests on its table. A fixture by this definition, is any work holding device that becomes, temporarily at least, part of the machine while in use. This definition places most work holders in the fixture class.

Wheel Fit Pressures

PRESS fits of various kinds have been the subject of much argument and discussion for many years. The old rule-of-thumb of allowing "a thousandth per inch of diameter" has been modified many times, but has served fairly well in numerous cases. There are, however, marked variations, some railroads allowing double this amount, or 0.002 in. per in. of diameter on wheel and crankpin fits, and finding this allowance ordinarily satisfactory.

Three factors affect both the pressure and the kind or quality of the fit aside from size itself. These are the quality of the surface, the length of the fit and the elastic limit of the materials used. If one will study the surfaces of car axles after wheels have been removed the effects on the axle surface will be apparent.

Some axles will be found very smooth as though they had been shaved by the edges of the axle hub as it went on. Others will be seen where the wheel seat has had only a narrow bearing on the top of the ridges, or threads, left by the turning tool. The difference in area of the contacting surface and probably in the mounting pressure is surely enough to affect the dependability of the wheel fit. If the small contact holds the wheel against all loosening stresses a full bearing must give a large factor of safety. Then, too, there is the effect on the metal itself.

Where the fit allowance, or difference in diameter of wheel and axles, is too great, it may be possible to exceed the elastic limit and stretch the metal of the hub enough to give a loose fit instead of one that is extra tight. Danger of this has been reduced by the improved quality of metal now available. Careful study of a large number of experiments shows that the pressure on the axle itself increases its strength. As a result some driving axles are now rolled under heavy pressure adjacent to the axle journal to increase its strength. The effects are reported to be much greater than expected.

Taking specific cases of wheel and axle fits we find the following from a large road:

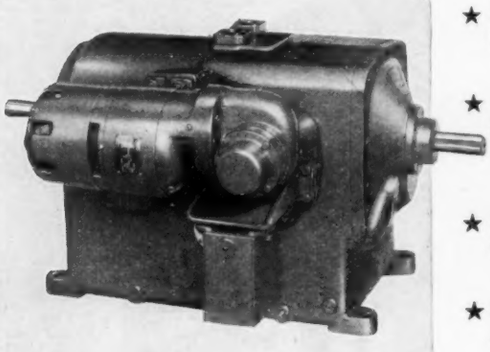
Axle Diam.	Hole in Hub	Pressure Required
10 in.	9.975 in.	110 – 150 tons
11 in.	10.975 in.	121 – 165 tons
12 in.	11.976 in.	132 – 180 tons

On another road, the figures are:

Axle Diam.	Hole in Hub	Pressure Required
10 in.	9.980 in.	150 – 180 tons
11 in.	10.981 in.	160 – 200 tons
12½ in.	12.479 in.	180 – 220 tons
13 in.	12.977 in.	190 – 240 tons

A study of these two tables reveals several differences. The first two have a greater allowance in diameter, but the fit is made with much less pressure. While the other figures are not directly comparable, a similar difference is shown in the pressure required for mounting the wheel on the axle.

It seems quite probable that these differences may be due to different



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★ Accurate Stepless Speed Control . . . Minimum to Maximum in either direction

★ Automatic Load Indication and Overload Protection

★ Flexible Location with Hand, Automatic or Remote Control

★ High Efficiency, Low Maintenance

★ Smaller Size, Lower Cost

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OILGEAR *Fluid Power*

VARIABLE SPEED TRANSMISSIONS

qualities of surface in the bore or on the wheel seat, or both. This is a case where a workable standard of surface finish would make wheel fits more easily comparable. Some roads also turn the axles with a slight taper, such as from 0.005 to 0.008 in. in the length of the wheel seat.

Less Wear in Rail Joints

CLATTER and vibration produced by the wheels of a railroad train passing over the gap between rails every 30 ft. or so is a source of annoyance to the passengers and a source of expense to the railroads. It has been realized that if rails could be made of an extremely hard metal the wear resulting from this pounding could be largely eliminated.

Because of the prohibitive expense of using such hard materials for the entire rail the problem remained unsolved until hard surfacing by welding came into use. As pointed out by E. W. P. Smith, of the Lincoln Electric Company, in a recent paper before the American Welding Society, a small amount of hard but expensive steel may be used on the worn ends of a rail just where hardness is needed to prevent wear. Railroads in this way are now increasing passenger comfort and at the same time they are salvaging otherwise scrapped worn rails.

Two other methods are being used to attack the problem of rail ends; both of these use welding apparatus. In one method, the gap between rails is eliminated by fusing the rails together. In the other method, the ends of the rails are hardened by the heat of an oxy-acetylene torch followed by the quenching action of a jet of water.

Plane Production

MEN who have visited airplane factories abroad come home with glowing accounts of the progress being made in other countries. Some overlook the fact that aircraft production in the United States is on a peacetime scale, while others are geared for war. Most of them forget, or never knew, some of the war achievements under stress in 1917-1918.

True, our record of planes built and used in the war is a dark spot in our history. The planes that got over were so bad they burned them rather than bring them back. But that reflects on the military end and not on ability to manufacture. One of the examples of what our shops can do in emergencies is the building of Liberty engines by Ford at the rate of 50 every eight hours after they got into their stride.

Of course, Liberty engines are out of date now, but they were good enough for foreign consumption after the war. Many a cargo of bootleg liquor owed its safe landing to the speed and stamina of Liberty engines which the army sold as surplus stock at a price that was all too low. Give us good designs and the "go-ahead" and we, too, can build engines and planes at a rapid rate.

Ultimatums

ONE of the most successful managers we know has but one hard and fast rule in dealing with labor—never to issue an ultimatum. Don't get the idea that he is an easy mark for every one with a fancied griev-

Hot Rolled Alloys

S.A.E. 2315, 2320, 2330, 2335, 2340, 2345, 2350, 3115, 3120, 3130, 3135, 3140, 3250, 4140, etc.
Rycase (hot rolled, machine straightened).
Rytense A.A. (hot rolled, machine straightened).

Cold Drawn Alloys

S.A.E. 2315, 2320, 2330, 3115, 3120, 3135, etc.

Heat Treated Alloys

Ryco (hot rolled, machine straightened).
Nikrome (hot rolled, cold drawn, machine straightened).

Stainless and Heat Resisting Alloys

Allegheny Metal (Sheets, Bars, Welding Rod, etc.).

Cold Finished Steels

Std. Shafting, Turned, Ground and Polished, Special Accuracy Stock. Rycase High Manganese Screw Stock, S.A.E. 1020, 1035, 1112, 1120, etc.

Tool Steels

Ryerson B.F.D. Die Steel. Ryerson "Shock" Steel. Ryerson V.D. Steel.

General Steel Products

All steel products such as Bars, Structurals, Plates, Sheets, Strip Steel, Welding Rod, Tubes, etc.

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There are ten Ryerson plants ready to serve you. Each plant is strategically located for quick, economical distribution of steel throughout its own industrial area. In every plant there is a strong experienced organization and complete facilities for cutting, bending or forming the material to your specifications. Draw on the Plant Nearest You.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cleveland, Cincinnati, Detroit, Boston, Buffalo, Philadelphia, Jersey City

RYERSON

ance. He has kept his plant going when a lot of stiff-necked captains of industry were shut down. He has secured more production from mediocre equipment than many did from better machinery. He knew men and how to handle them—with all his cards on the table.

He remembers when 60 hours was a week's work, and talk of 55 or even 48 hours was rank heresy. He is no more anxious to abandon the 40-hour week than anyone else, but he realizes that it, and practically all other questions are at least debatable. He much prefers to talk with his own men, and they generally do their own representing. But he knows that they have the same right to be represented by anyone they choose just as he picks a bright lawyer to represent him in court. And above all he avoids "statements of policy" and ultimatums that make all settlements harder for everybody when the time comes.

No Runout

CHUCKS INTERCHANGEABLE

with the NEW Standard Key Drive taper SPINDLE NOSE

standard equipment on

ALL LeBLOND Lathes The illustration shows the extreme simplicity of the LeBlond Standard Key Drive Taper Spindle Nose that sharply steps up lathe efficiency; saves time, labor, and operation costs. Only three sizes of spindle drives are required on 12 inch to 36 inch lathes . . . all chucks and fixtures are interchangeable on the same, or on different lathes within the range of the three sizes . . . *and with no runout!*

A manufacturer of bottle molds says: "... the only Spindle Nose ever built on which you can mount chuck, remove it, remount it again and have it run true."

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FREE BROCHURE... giving complete details of the eight outstanding superior advantages of the New Spindle Nose mailed on request.

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HALF CENTURY OF SERVICE TO INDUSTRY

High Cost of Spare Parts

PRICES of spare parts has long been a bone of contention between manufacturer and customer. Many times the cost of separate replacement parts seems abnormally high. The customer, however, frequently overlooks all but the original cost of the part when made for regular production. This, in many cases, is only a small part of the total cost when a part has been carried in stock for an extended period.

Some idea of this added cost may be had from a glance at the storehouse of any manufacturer who has been in business for some time. The illustration is simply typical of storage shelves for spare parts that may be found in many plants. The parts

in the foreground are, for the most part, from current models. The shelves, however, carry parts that run back over a number of years, and represent an ever increasing cost to the manufacturer. They not only have to be inventoried each year, but they occupy space that costs money in investment of both land and building, in taxes and insurance. In addition there is the investment in the piece itself, to which must be added all the items mentioned.

Maintenance costs should always be kept as low as possible. But it is well for those who patch up old machines to realize that the original cost of the part purchased may have been multiplied several times since it was made.

Wear From Here To There

SHOP transport, or the handling of materials before, during and after machining, plays a large part in efficient manufacturing and total costs. In one instance a few years ago the installation of a continuous conveyor so increased production that a new building, which had been planned, was not necessary. Part of this saving was because parts in process were

"stored in the air" on the conveyors.

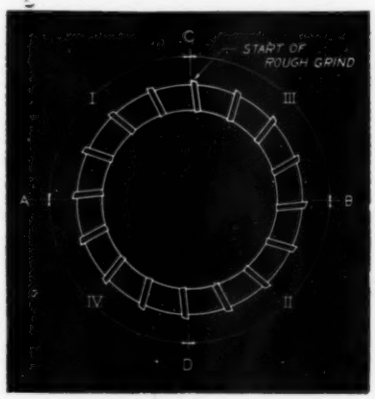
Shop transport, however, includes shop trucks, both hand and power, hoists, cranes and even the lowly tote box. Routing of work is also tied closely with transport and its cost. One shop found that trucks were wearing the floors rapidly. A study of the flow of material resulted in a new routing that reduced the distance traveled by over one-half. This saved wear on floors and greatly reduced the wear on trucks, saved time in handling and speeded the flow of work from start to finish.

Flow sheets should be made first and the handling methods designed and arranged to fit the case in hand.

Wheel Wear in Cutter Grinding

A VARIATION in the commonly used method of grinding large face milling cutters has been found to improve the finish on the milled surface. Rough grinding is done in the conventional manner by making a chalk mark at the start and grinding all the teeth in the cutter around the periphery.

Then the cutter is chalk marked into four equal sections shown as I, II, III and IV. Beginning at *A* the teeth in Section I are finished ground up to the beginning of the rough grind at *C*. Next, starting at *B* the teeth in the opposite Section II are finish ground. In the same manner the teeth in Section III are finish ground beginning at *C* and



finally those in Section IV are ground from *D* back to *A*.

When solid milling cutters or those with inserted teeth of Stellite J-Metal are ground in the usual manner, wheel wear may detract from the accuracy of the sharpened cutter blades. By grinding section by section, however, this wear is equalized with correspondingly good results.

Less Dead Weight

FREIGHT cars cannot compete with streamlined, high-speed passenger trains in spectacular public interest. But the use of modern steels and methods for freight transport may spell dollars in earnings, just as the new pasenger service does. Now comes the D & H railroad with a nominally 80,000-lb. hopper coal car having a light weight of 32,600 lb. In reality it is a 50-ton car. With the maximum load allowance of 103,400 lb. this gives a pay load to dead weight ratio of over 3 to 1.

Alloy steels and welded construction are largely responsible for this reduction in dead weight. Part of the weight has been saved in rivet elimination alone, there being only 277 in comparison with 2576 rivets in the car of conventional design. The number of pieces has also been reduced from 3596 to 1153. Trucks and such structural parts as door

stops are also of alloy steel, to secure adequate strength with reduced over-all weight.

Burnishing of Zinc Die-Castings

HERBERT CHASE

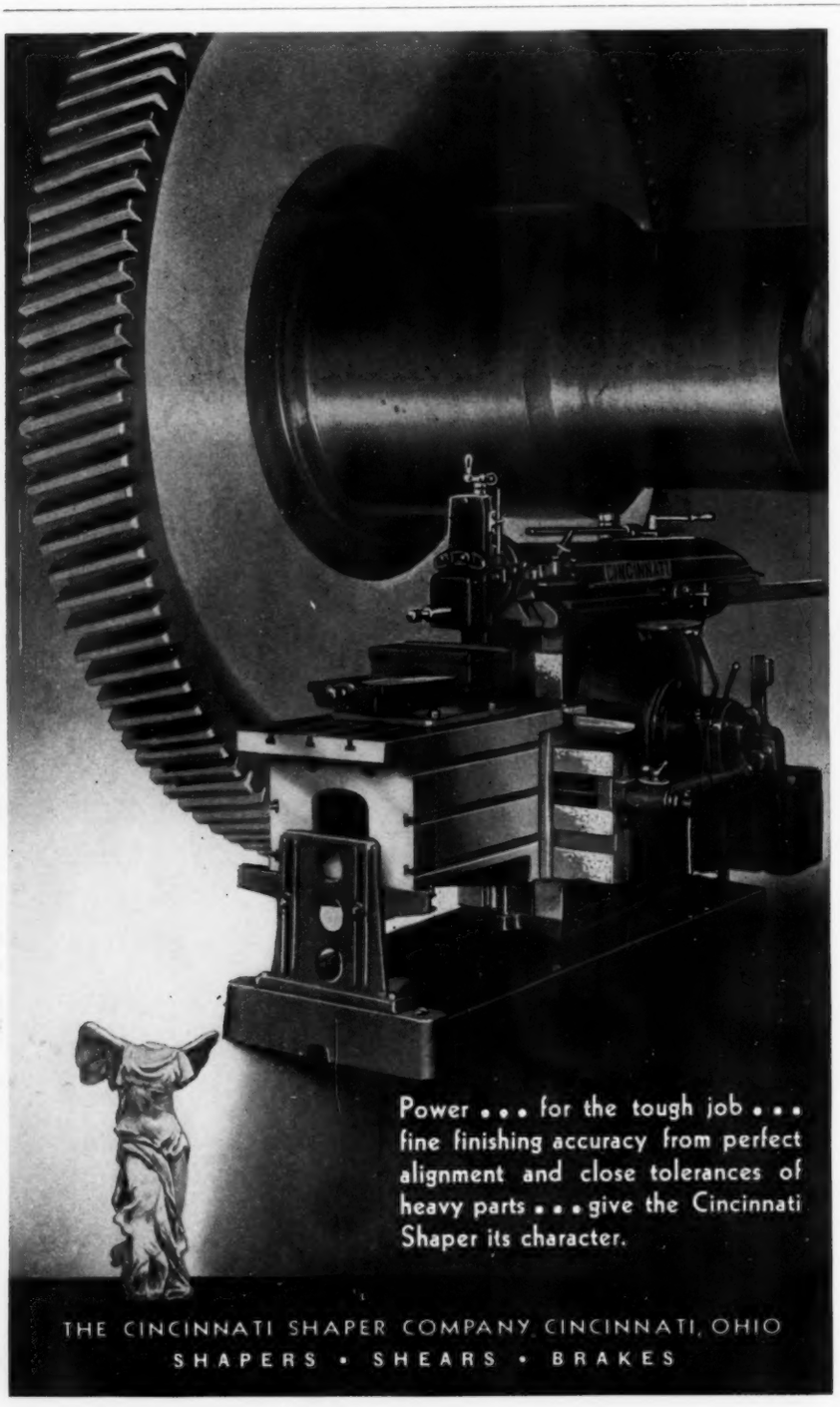
ALTHOUGH some burnishing of zinc alloys, especially those used in die-castings, has been done by certain producers and finishers of such products, the processes used have rarely been made public. It is generally supposed that zinc alloys are either not burnishable or require so much development of the burnishing process for satisfactory results that other methods are used. Wheel polishing and buffing is commonly used prior to plating and gives excellent results, but until recently, such burnishing as has been done is much less satisfactory. Buffed surfaces tarnish quickly under ordinary atmospheric exposure and when prepared for plating, chemical cleaning and plating should follow immediately.

Extensive experimental work on burnishing zinc die-castings done by the Lupomatic Tumbling Machine Company, Inc., has resulted in a commercial process which gives the castings an excellent appearance, and one which is retained, it is stated, after months of indoor exposure. Examination of samples submitted seem to bear out this contention. The following particulars are based on information furnished by the company named, which specializes in tumbling work and equipment and in the materials used in tumbling. Parts processed in the manner described below have a finish considered equal to or better than that obtained ordinarily in hand polishing and buffing and in addition the parts burnished remain free from tarnish for long periods and can be set aside for plating at a later date.

In the burnishing process, the following procedure is recommended, the mixtures referred to being standard types prepared in patented processes developed by the company. Tumbling is done in wood-lined barrels of standard pattern 30 in. in diameter by 36 in. long and having two compartments. "Cutting-down" chips employed are especially treated and hardened to withstand prolonged use.

Three separate operations are required to produce the high and enduring luster by the burnishing method in question. In the initial or "cutting-down" operation, a coarse abrasive mixture is employed in combination with-cutting-down chips. The time required varies with different conditions, including the initial degree of smoothness in the die castings treated.

In the second operation, the use of cutting-down chips is continued, but a standard type of burnishing compound, especially developed for this work is employed and the tumbling is done dry. Lustering or "coloring," as it is often termed, is accomplished in the final tumbling operation. In this, either of two different methods may be employed. For one, coloring chips are used and for the other a standard coloring compound. No set rules have been established as to which of the two is the better. Some castings appear to give better result with one and some with the other coloring process, and this is best determined by tests which are commonly run in cases where castings of different size, hardness, shape and the like are involved. For such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determinations and for establishing the best procedure as to proportions of mixture and length of tumbling in the first two operations, the company maintains a special experimental department. Tests made there also determine the best size of equipment, the speed at which it should operate and the quantities to be handled to insure optimum results.

In general, it may be said that small die castings require a total of 18 to 36 hours of tumbling and that larger sizes take from 23 to 40 hours for the entire process. Some require low speed and some high speed. The number of variables is so great that specific rules applicable in all or even to a majority of cases cannot be given, but full data are supplied after the general run of work is known and the particular problem has been studied. Such procedure, in fact, is in line with that commonly required for best tumbling practice with almost any product.

An important advantage of burnishing by tumbling, aside from its low cost as compared to wheel polishing and buffing each piece separately, is that it cleans in recesses and inside corners, concave surfaces or depressions, as well as on surfaces which are flat or convex and thus does a job which is difficult or commercially impractical in grinding and buffing. This may be of little moment on pieces of such shape as to lend themselves to ready buffing, but in other cases it makes possible work which could not be done on a feasible basis otherwise. Although there may well be a limit to the size of die castings which can be burnished successfully, there appears to be a field of usefulness for the process.

NEW BOOKS

SYMPOSIUM ON HIGH-STRENTH CONSTRUCTION METALS.—*126 pages, 6 x 9 in. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price, Cloth-board cover, $1.50; heavy paper cover, $1.25.*

In this volume are presented papers and discussions which made up a symposium held in conjunction with the seventh regional meeting of American Society for Testing Materials, under the auspices of the Pittsburgh District Committee. Papers cover chemical and physical properties, also manufacturing and fabricating properties, of metals and alloys used in buildings, bridges, ships, railway car bodies, automobile bodies, airplane wings, tanks and containers. The principal groups dealt with are alloys of aluminum and magnesium, alloys of copper, alloys of nickel, carbon and low-alloy steels, and corrosion-resisting steels.

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BUSINESS EXECUTIVES' HANDBOOK—*Edited by Stanley M. Brown. 1281 pages, 4⅞x7¾ in. Limp leather binding. Indexed and illustrated. Published by Prentice Hall, Inc., 70 Fifth Ave., New York, N. Y. Price, $7.50.*

The handbook has long been the tool of engineers and has made a place for itself as a source of a great mass of engineering data repeatedly used. From this start the handbook graduated into the field of management, and several compilations of information useful to industrial executives have been made.

The volume under discussion goes

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WOONSOCKET RHODE ISLAND

one step further. It is a management handbook, but deals exclusively with the business phases of company operations, as distinguished from problems of production and personnel. It treats of such topics as selling, advertising, purchasing, insurance, credits, business letters, business mathematics, and the general structure of a corporate or partnership organization.

Subjects are covered in terse condensed form following recognized handbook practice. Because of the nature of the material contained, there is less opportunity for tabular treatment, and much of the content is made up of short articles grouped together under appropriate paragraph headings. Chapters on construction and analysis of financial statements are especially well worked out.

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MATHEMATICS OF MODERN ENGINEERING, VOLUME I.—*By Robert E. Doherty and Ernest G. Keller, 314 pages 6 x 9¼ in. Cloth-board covers. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price, $3.50.*

In this volume the authors have done much to show how mathematics can be applied to those branches of physics that lie in the field of engineering. The only pre-supposed requisite for understanding this volume is a thorough knowledge of calculus.

After describing the method of mathematical formulation of engineering problems, modern engineering mathematics is studied by showing the underlying idea and purpose in back of differential equations, determinants, Fourier's series, dimensional analysis, vector analysis, vector fields, dyadics, and Heaviside's operational calculus, and the manner of using these principles in the solution of typical case problems.

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TRADE PUBLICATIONS

ARC WELDING. A 23-page catalog covering the 40-volt simplified electric arc welding machine is offered by Hobart Bros., Box FR-173, Troy, Ohio. This catalog includes a complete description of the equipment, specifications are given and various jobs suitable for this equipment are illustrated.

BERYLLIUM COPPER. The properties, heat-treatment, fabrication and application of beryllium copper is discussed in a folder recently published by the Beryllium Corporation of Pennsylvania, Reading, Pa.

DUST ARRESTER. Bulletin No. 163-1, published by The Northern Blower Co., West 65th St., Cleveland, illustrates and describes the "Norblo" bag-type dust arrester. Cloth bags are used as a filtering medium and they are so arranged that they are accessible and easily inspected.

ELECTRIC FANS. A 28-page catalog, Unit No. X-1949, published by The Emerson Electric Mfg. Co., St. Louis, Mo., illustrates and describes the complete 1937 line of Emerson-Electric desk fans, ceiling fans, air circulators, ventilating and exhaust fans.

OPERATING VALVES. Ross Operating Valve Co., 6488 Epworth Blvd., Detroit, is mailing copies of Catalog No. 36 which lists and describes various models of hand-, foot-, mechanical- and electrically-controlled operating valves for single- and double-acting air cylinders used on mechanical equipment.

FACTORY LIGHTING. A 36-page handbook entitled "A Manual of Factory Lighting Practice" has been published by Benjamin Electric Mfg. Co., Des Plaines, Ill., to provide the operating executives with information on commonly encountered problems of factory lighting. Thirty lighting problems are discussed and definite recommendations are given.

FINANCIAL STABILITY. "Fourteen Guides to Financial Stability," by Roy A. Foulke, is a 43-page booklet published by Dun & Bradstreet, Inc., 290 Broadway, New York, N. Y. This is a supplement to the 1936 edition of "Behind the Scenes of Business." Important balance sheet and operating ratios for 60 lines of business are included in this study.

HAND-LIFT TRUCKS. A complete line of hand-lift trucks is described and illustrated in a mailing folder offered by The Yale & Towne Manufacturing Co., 4530 Tacony St., Philadelphia, Pa.

HOISTING EQUIPMENT. The Wright Manufacturing Div., American Chain & Cable Co., Inc., York, Pa., is offering a catalog on hoisting equipment that includes specifications on hoists, trolleys and cranes.

HOUGHTON PRODUCTS. The current issue of "Research Illustrated," published by E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, is devoted to a discussion of the various Houghton products available for the metal working industries.

LEATHER PRODUCTS. Alexander Bros., Inc., Philadelphia, has published catalog No. A-116 which describes the lines of leather belting and industrial leathers now available. This 32-page catalog includes several tables of statistical data that will be of interest to operating men and purchasing agents.

LUBRICATION. The Alemite Div., Stewart-Warner Corp., 1826 Diversey Parkway, Chicago, has published a 56-page industrial catalog with the title "Alemite Controlled Lubrication." The entire range of available industrial equipment is described and illustrated.

MATERIALS HANDLING. Lewis-Shepard Co., 175 Walnut St., Watertown, Mass., has issued folder No. 321 describing equipment for handling barrels, drums, carboys, cartons, cases and similar loads. Standard trucks, elevators, racks and cranes are illustrated and described.

RUBBER HOSE. A 48-page illustrated catalog, published by United States Rubber Products, Inc., 1790 Broadway, New York, N. Y., with the title "U. S. Hose Catalog," is designed to provide a source of easily accessible information on rubber hose for industrial use.

SURPLUS TAX. "The Coming Effect of the Surplus Tax on Factory Employment," No. 20 in a series of booklet-editorials by Allen W. Rucker in collaboration with N. W. Pickering, is announced by Farrel-Birmingham Company, Inc., Ansonia, Conn. This study suggests that the first adverse effect of the 1936 Revenue Act and its surtax on undistributed earnings will be a substantial impairment of job security.

VARIABLE SPEED TRANSMISSION. A mailing folder offered by New Departure, Division of General Motors Corp., Bristol, Conn., describes the advantages of the "Transitorq" variable-speed transmission and illustrates several recent applications to machine drives.

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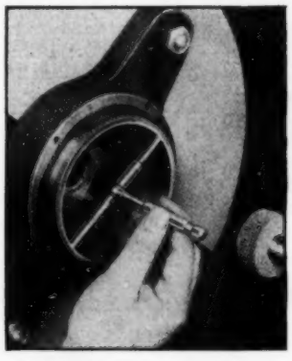

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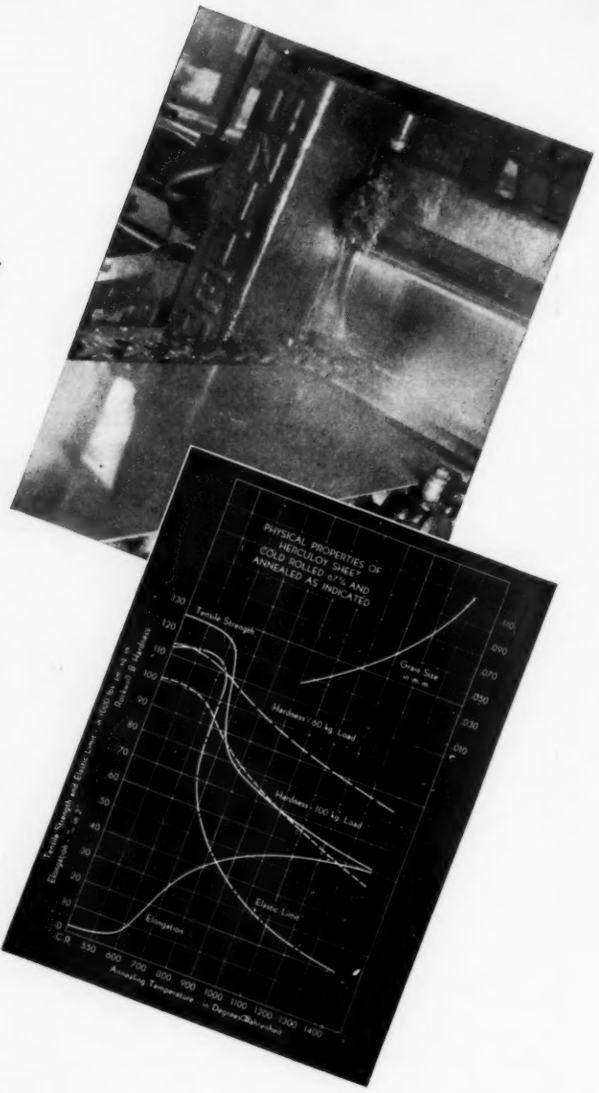
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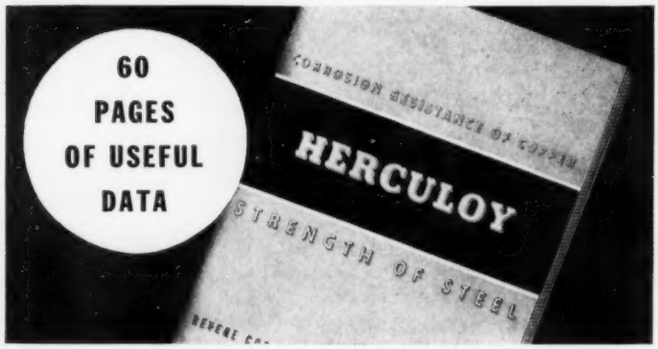

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